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FROGGATT (J. L.). **The Long-horned Tree-hopper of Coco-nuts, *Sexava* spp.**—*New Guinea agric. Gaz.* **1** no. 1 pp. 16–27. Rabaul, October 1935.

Field and laboratory investigations on the Tettigoniids of the genus *Sexava* that are a serious pest of coconuts in the Territory of New Guinea [*R.A.E.*, A **21** 683] were begun in 1929. They are distributed over the whole of the territory except for some of the outlying islands. Two species have been identified from this area, *S. nubila*, Stål, and *S. novae-guineae*, Brancsik. The only other record of species of this genus as pests of coconuts is from Netherlands New Guinea and the Moluccas [*cf.* **16** 129].

Of various soils offered for oviposition in the laboratory, most eggs were laid in a loose, moist sandy loam. More eggs are collected in the field from bare sandy ground, and infestation is always worse in such areas. Eggs are also commonly found in rotting logs and the bases of rotten fronds. Oviposition takes place at night in the field. The eggs are laid singly, generally about ½ in. below the surface. The maximum number laid by one female in one night was 16. The total number of eggs laid was usually 20–30 with a maximum of 41, but dissected females contained many more. The incubation period varied from 42 to 100 days. A few nymphs hatched within 10 days from eggs kept in dry soil for 119 days and then transferred to moist soil. The nymphs usually hatch in the early evening and ascend the palms within 24 hours. The nymphal stage lasts 20–22 weeks for males and 21–26 for females, the males moulting 6 times and the females 7. The nymphs start to feed almost at once, beginning with the tips of the leaflets of the older fronds, and gradually spread upwards, leaving the new fronds to the last. The adults eat about 4 sq. ins. each in 1 day and the oldest nymphs 3·3, but the latter can live without food for a week. They require a certain amount of water each day. The life-cycle occupies about 4–5 months. In Rabaul the egg-stage took 65–66 days and the nymphal stage 78–82. In New Hanover the eggs hatched in 56–85 days, and the males matured in 88·5 days and the females in over 100. The measurements of the various instars and of the adults are given. In the laboratory the males lived a maximum of 71 days and the females 90. The sex ratio in the field appears to be about 55 per cent. females. In the Manus and New Britain areas numbers of adults come down from the palms on damp nights and then reascend them. Other food-plants are banana, *Heliconia*, wild sugar-cane, sago and *Areca* palms, of which *Heliconia* is reported to be preferred to coconuts in some localities. The insect may be distributed in soil, or on epiphytic growths, orchids and coconut fronds infested with eggs. Spread is very gradual in plantations, as there is no mass migration.

A visit was made to Amboina in February 1933 to study certain parasites of *Sexava* [**16** 130], and colonies of the most important, *Leefmansia bicolor*, Wtstn., were reared there and shipped to Manus in April 1933. This Encyrtid bred readily in the eggs of *S. nubila* and *S. novae-guineae*, which is not present in Amboina. Three generations were reared in the laboratory, and the first liberation was made in the field on 26th June. Later the parasite was found to be definitely established, and in 1934 it was also established in New Hanover. The methods of rearing and liberation are described. Unless newly parasitised eggs are spread out to dry for a few hours, " sweating " takes place in storage and large numbers of parasites are destroyed.

(534) Wt. P15/3619 1700 4/36 S.E.R. Ltd. Gp. 353. [A] A

They emerged in 25–30 days. As many as 50 emerged from 1 egg, the average being 20–30. All usually emerged within 24 hours of each other, but in a number of instances a definite hiatus in emergence of 14–56 days was noted. The parasites emerged over much longer periods from eggs set out in the field. *Sexava* eggs in batches of 10–20 exposed to a single female of *L. bicolor* have yielded as many as 19 parasites, the average being 17. The adults lived for an average of 8–9 days when fed on sugar syrup, but died within 1 day without food. They emerged readily from eggs buried in moist soil to depths of $\frac{3}{4}$ in.

Native egg parasites in the Manus district were a Mymarid bred from eggs found in epiphytic growths on palm trunks, and a Eulophid and two Scelionids, *Prosapegus atrellus*, Dodd, and an unidentified species, from eggs collected in soil. All were comparatively rare. In New Hanover a Trichogrammatid, *Doirania leefmansi*, Wtstn., an Encyrtid very similar to *L. bicolor*, and a Mymarid are generally distributed, *P. atrellus* and a Eulophid are comparatively rare, and a Trichogrammatid was reared on one occasion. *D. leefmansi* and the Encyrtid have been bred in the laboratory, their respective life-cycles averaging 39·5 and 32·5 days. A Eulophid was bred on 2 occasions from eggs collected in New Britain, and a Mymarid and *P. atrellus* in New Ireland.

In localities where the insects come down from the trees at night, they should be collected and destroyed. Thoroughly turning over the soil will expose eggs to ants and to desiccation. Dry conditions materially decrease infestation, partly owing to desiccation of the eggs and also because drought is injurious to the nymphs. Areas in which there is a definite dry season each year are therefore not subject to such severe infestation. Baits of Paris green and bran were not attractive to the insects. Tanglefoot bands 4 ins. wide applied to 19 palms 5 ft. from the ground remained sticky for over 4 months and trapped 2,706 nymphs mostly in the first and second instars. In some cases nymphs that crossed the bands carried away some of the material on their feet and were caught by ants. When sodium arsenite, sodium fluoride, and Paris green were added to the tanglefoot in the laboratory all the nymphs died in 39, 78 and 120 hours respectively. Mercury bichloride produced a rapid paralysis, but the nymphs did not die until 168 hours afterwards.

Dwyer (R. E. P.). **Derris. Its cultural and economic Possibilities for the Territory of New Guinea.**—*New Guinea agric. Gaz.* **1** no. 1 pp. 28–41, 20 refs. Rabaul, October 1935.

In view of the low price obtained for copra, the introduction of derris as an economic crop in New Guinea is being considered. Much of the information in this paper is taken from the literature. Derris as a source of rotenone and its occurrence and use as a fish poison in New Guinea, where the true *Derris elliptica* is known to be present, are discussed. J. L. Froggatt reports that a Bostrychid, *Xylothrips religiosus*, Boisd., causes severe damage to dried derris root in New Guinea. The insecticidal properties of rotenone and methods of extracting it, together with its use in various insecticidal mixtures, are briefly outlined. The importance of the selection and propagation of suitable varieties of the plant is stressed, as different varieties vary widely in rotenone content. Methods of cultivation, the preparation of the roots for market, and manufacture for commercial use are briefly described. Chemical analysis of bulk samples of derris root

from New Guinea showed that the rotenone content and total carbon tetrachloride extract compared favourably with samples of Malayan root, although the samples from both sources gave a somewhat lower analysis than the accepted standard. The economics and future possibilities of derris are briefly discussed.

CHEO (MING-TSANG). **A preliminary List of the Insects and Arachnids injurious to Economic Plants in China.**—*Peking nat. Hist. Bull.* **10** pt. 2 pp. 93–114. Peiping, December 1935.

This list, which is in continuation of a previous one [*R.A.E.*, A **23** 721], comprises 172 Homoptera, 6 Hymenoptera and 3 Isoptera. The distribution of the insects in China and the plants attacked are shown.

SHIBATA (K.). **Studies on the Supercooling Death of Insects.**—*Mem. Fac. Sci. Agric. Taihoku Univ.* **16** no. 2 pp. 91–103, 11 refs. Taihoku, August 1935. [Recd. January 1936.]

It is concluded from experiments on *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., that the death of insects may be brought about by cold in two ways, by freezing and by supercooling. Larvae of *D. cucurbitae*, when exposed to temperatures below the freezing point of their body fluid, did not always freeze, but remained in a supercooled condition if they were kept completely undisturbed and without mechanical shocks. When the supercooling condition was maintained, however, the larvae eventually died, although no ice-crystals were formed in their bodies. As death required a much longer period of time when due to supercooling than when due to freezing, it is believed that the process by which it is brought about must be of a different nature. The larvae were killed in 25 minutes when completely frozen at −3·4°C. [25·88°F.] ; in 20 minutes at −5°C. [23°F.] ; and in only 4 minutes at −12°C. [10·4°F.]. On the other hand 16 hours was required to kill them by supercooling at −3·4°C. ; 8 hours at −5°C. ; and 2 hours at −12°C. The supercooling point could be lowered either by preventing mechanical shocks from outside or by slowing the rate of cooling. When exposed to −5°C., 55 per cent. of the larvae kept in a lidless dish froze after 24 hours, whereas 38·8 per cent. of those in a covered dish and only 3·9 per cent. of those packed with cotton wool froze within the same period.

SHIBATA (K.). **Studies on the Death-Temperature of a Fruit-fly, *Chaetodacus cucurbitae* Coquillett, at the Frozen State and the Influence of Supercooling upon its Temperature.**—*Mem. Fac. Sci. Agric. Taihoku Univ.* **16** no. 2 pp. 105–116, 2 figs., 10 refs. Taihoku, August 1935. [Recd. January 1936.]

Experiments were carried out to determine the thermal death point of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., in the frozen state and the proportion of ice-crystals that must be formed within its body to bring about death by freezing. The larvae were exposed to temperatures of −5°C. [23°F.], −8°C. [17·6°F.] and −11°C. [12·2°F.] and were given mechanical shocks to produce freezing. As soon as the formation of ice-crystals takes place the body temperature rebounds and then falls again. When it had fallen to a given degree, the larvae were taken

from the thermostat into normal room temperature (15–20°C. [59–68°F.]) and protected by a piece of cucumber. They were examined after 24 hours. No larvae the body temperature of which had fallen to −4°C. [24·8°F.] or −3·6°C. [25·52°F.] after the rebound were alive ; the majority that had reached −3·2°C. [26·24°F.] were dead, a few being moribund. After reaching −2·8°C. and −2·6°C. [26·96°F. and 27·32°F.] about 15 per cent. were dead, 50 per cent. were moribund and 35 per cent. survived. No larvae that reached −2·2°C., −1·9°C., or 1·5°C. [28·04°F., 28·58°F. or 29·3°F.] were dead but a few were moribund ; and all that reached −1·2°C. and −0·8°C. [29·84°F. and 30·56°F.] were alive. Thus the lower the larval temperature falls the higher the percentage of deaths. If the formation of ice-crystals is proportional to the fall in temperature of the insect after the rebound, then the more ice-crystals are formed in the body the higher will be the mortality.

A second series of experiments was carried out to determine the influence upon death from freezing exerted by previous supercooling. The larvae were cooled slowly and kept in the thermostat in a supercooled condition at −2·9°C. [26·82°F.], mechanical shocks being applied to them to cause the formation of ice-crystals after a given number of hours. They were then treated as in the previous experiment. The results showed that the longer the time spent in the supercooled state the higher the death-point by freezing. After supercooling for longer than about 6 hours almost all the larvae were killed by a temperature as high as −0·8°C. [30·56°F.], which proved to be the normal freezing temperature of this larva.

SHIRAKI (T.). **Insect Pests of Citrus Trees in Formosa I, II & III.**—*Contr. ent. Lab. Taihoku Univ.* no. 50 1934. (Repr. from *J. Soc. trop. Agric.* **6** nos. 1–4 pp. 29–36, 187–194, 697–703. Taihoku, 1934.) [Recd. January 1936.]

The first two parts of this paper have already been noticed [*R.A.E.*, A **22** 711]. In the third, brief notes are given on 27 minor pests including 7 Lymantriids, 7 species of *Papilio*, 12 Coleoptera, an ant and *Dacus* (*Chaetodacus*) *dorsalis*, Hendel.

SATO (T.). **Observations on *Moricella rufonota* Rohwer and the Forms of young Camphor Trees injured by it.** [*In Japanese.*]—*Taiwan no Sanrin* no. 116 pp. 1–16, 3 figs. Taihoku, December 1935.

In Formosa, the sawfly, *Moricella rufonota*, Rohw., all stages of which are described, is very injurious to young camphor trees [*Cinnamomum camphora*] from March to July. It has at least three generations a year, completing its life-cycle in 20–30 days. The adults do not fly actively. The eggs are laid in the leaf tissues and hatch in 3 or 4 days. The larvae, which are gregarious, prefer young leaves and buds, and may retard the growth of the trees by about 30 ins. a year. They are common in shady situations and are most injurious in densely planted nurseries. When attacked at the tops of the stems, the seedlings or young trees often branch ; trees with branched stems contain less camphor than those with single ones. Planting the seedlings sparsely, collecting the adults and larvae, and spraying with petroleum oil emulsion are recommended for control.

SONAN (J.). **On** *Lymantria serva* **Fab. var.** *iris* **Strand, a great Pest of** *Ficus retusa*. [*In Japanese.*]—*Formosan agric. Rev.* **31** no. 12 pp. 1043–1047, 1 pl. Taihoku, December 1935.

Near Taihoku, the larvae of *Lymantria serva* var. *iris*, Strand, all stages of which are described, feed on the leaves of *Ficus retusa* and sometimes entirely defoliate it. There are three generations a year, the moths being found in May–June, August and October. The eggs are laid in groups of 200–500 in crevices on the food-plant and hatch in 13–14 days. The adults and larvae are inactive during the day, the latter grouping in crevices on the stems. The pupal stage lasts 12 days in summer. Many of the larvae are killed by a fungus, and some are parasitised by *Tricholyga* sp., while about 10 per cent. of the pupae are destroyed by a Chalcid. The Pentatomid, *Cantheconidia furcellata*, Wolff, preys on the larvae and adults, but is very scarce. Collecting the larvae in the evening, when they begin to be active, and spraying with lead arsenate are recommended for control.

SONAN (J.). **On** *Lymantria xylina* **Swinh., a serious Pest of** *Acacia* **and** *Casuarina*. [*In Japanese.*]—*Formosan agric. Rev.* **32** no. 1 pp. 51–57, 1 fig. Taihoku, January 1936.

The larvae of *Lymantria xylina*, Swinh. (*nigricosta*, Mats.) sometimes cause serious damage to *Acacia confusa* and *Casuarina equisetifolia* in Formosa in April and May, and also feed on tea and other plants. The pupal stage is passed in a cocoon and lasts about 12 days, the moths emerging in June and early July. The eggs are laid in masses on the branches of the food-plants, but do not hatch until the following April. All stages are described. *Tachina* (*Eutachina*) *japonica*, Tns., is a parasite of the larvae, but does not control them. Collecting the eggs, larvae and pupae, and spraying with lead arsenate are recommended.

A list is given of the 11 species of *Lymantria* now known in Formosa. These include *L. mathura*, Moore, and *L. nebulosa*, Wilem., which attack *Liquidambar formosana*, an important food-plant of *Saturnia pyretorum*, Westw.

MAKI (Y.) & TAMANO (M.). **Observations concerning** *Eumenotes obscura*, **Westw., a new Pest of Sweet Potato.** [*In Japanese.*]—29 pp., 5 pls., Oshima, Oshima Br. Kagoshima agric. Exp. Sta. Japan, October 1935. [Recd. February 1936.]

The Pentatomid, *Eumenotes obscura*, Westw., all stages of which are described, is very injurious to sweet potato in Amamioshima, an island to the north of the Loochoo Islands, and may be an introduced pest. It also feeds on *Calystegia sepium* var. *japonica*, which may be the original food-plant. The bugs are found on the stalks, sometimes two or three hundred being grouped on one plant, and when infestation is heavy the leaves turn yellow and the tubers are much reduced in size. There are two generations a year, the adults appearing in July and October. Those that appear in July begin to oviposit in 15–34 days. One female lays an average of 75·4 eggs in 16·5 masses during 42·2 days. The eggs are found in single rows on stones and fallen leaves, and seldom on the food-plants. Oviposition by the overwintered generation chiefly occurs in late April and May, but continues to the middle of August. The eggs hatch in 16–21 days, and the nymphs mature in 59–76 days and have 5 instars. The bugs prefer shady places, do not

fly, and drop to the ground when disturbed. They aestivate in sheltered places during the heat of summer and usually hibernate under stones, and sometimes among grasses and fallen leaves. The nymphs rarely pass the winter.

Resin wash and an oil emulsion containing pyrethrum are ineffective against this insect, but sprays of neoton (a derris insecticide) and nicotine sulphate kill the adults and nymphs. Collecting the insects, crop rotation, clean cultivation and the removal of *Calystegia* are recommended for control.

KATÔ (M.). **On the Chestnut Weevil, *Curculio dentipes* (Roelofs), especially on the Larval Stage.**—*Sci. Rep. Tôhoku Univ.* (4) **10** no. 3 pp. 515–554, 5 pls., 23 figs., 12 refs. Sendai, November 1935.

The results are given of the investigations in 1934 on *Curculio dentipes*, Roel., one of the two important insect pests of chestnuts in Japan, the other being *Cydia splendana*, Hb. The life-cycle of this weevil is generally completed in a year, but some of the larvae remain in the pupal cells in the ground over a second winter. In September–October, the adults emerge from the ground, pierce the chestnut burrs and feed on the nuts within before pairing, after which they oviposit in the brown inner skin of the nut shells. If a burr is too thick to be pierced with the rostrum, the eggs are laid in the burr itself and the resultant larvae die. The larvae hatch in about 12 days and have 4 instars, which average 7, 6, 8 and 7 days, respectively. When mature they make their way out of the nut into the soil to hibernate in pupal cells.

SHINJI (O.). **On the Migration of an Aphid that rolls the Leaves of Cherry.** [*In Japanese.*]—*Oyo-Dobuts Zasshi.* **7** no. 6 pp. 291–293. Tokyo, December 1935.

At Morioka, *Myzus sakurae*, Mats., migrates in July to *Elshaltzia patrini*, a plant of the family Labiatae, and returns to cherry in early October.

MURAYAMA (J.). **On the Food Habit of *Ithone mirabilis* Motsch.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **7** no. 6 pp. 313–317. Tokyo, December 1935.

The Coccinellid, *Aiolocaria* (*Ithone*) *mirabilis*, Motsch., is commonly found in alder forests near Keijo, Korea. The adults first appear in mid-March. The adults and larvae feed on the larvae and eggs of Chrysomelids, especially those on alder, and are of importance in their control, killing about 20 per cent. of the eggs.

KAWAGUCHI (T.). *Lepidosaphes conchiformis* **Gmelin and its Control.** [*In Japanese.*]—*Insect World* **39** no. 12 pp. 453–454. Gifu, December 1935.

Lepidosaphes ficus, Sign. (*conchiformis*, Gmel.), which is known as a serious pest of pear in Japan, has attacked persimmon in recent years. It is found on the twigs and fruit, which it deforms and discolours. Near Gifu, there are two generations a year, the adult females appearing

in August and again in autumn. The second generation adults hibernate and oviposit in May, the eggs hatching in late May and early June. Selecting uninfested young trees, spraying with oil emulsion or lime-sulphur, fumigation with hydrocyanic acid gas in winter, and pruning the infested twigs are recommended for control.

KUWAYAMA (S.). **Practical Examples of the Effectiveness of the Control of *Lema oryzae* Kuway.** [*In Japanese.*]—*J. Plant. Prot.* **23** no. 1 pp. 14–20, Tokyo, January 1936.

Methods adopted for the control of *Lema oryzae*, Kuwayama, in Hokkaido [*cf. R.A.E.*, A **22** 238] are spraying with calcium arsenate two or three times, the protection of parasites, and spraying with pyrethrum soap solution when necessary. When these methods are well carried out, the growth and yield of the rice are much increased.

KOJIMA (T.). **Knowledge of *Dicamptus nigropictus* Mats., a Parasite of *Dendrolimus spectabilis* Butl.** [*In Japanese.*]—*Bot. & Zool.* **4** no. 1 pp. 136–138, 3 figs. Tokyo, January 1936.

In Japan, *Dicamptus nigropictus*, Mats., an Ichneumonid parasite of *Dendrolimus spectabilis*, Butl., has one generation a year, the adults beginning to emerge in mid-June. A single egg is deposited in a host larva of the 7th or 8th instar. The larvae appear to have four stages, which are described. The parasitised hosts spin cocoons sooner than the normal larvae, and the parasites hibernate in the host cocoons, pupating in the following spring. The prepupae of this Ichneumonid are attacked by *Monodontomerus spectabilis*, Mats., which is sometimes a primary parasite of the pupa of the moth.

TSAI (Pang-hwa). **Epidemiological Experiments with the Paddy Borer (*Schoenobius bipunctifer* Walk.). I. The Influence of Temperature and Relative Humidity on Oviposition and Hatching.** [*In Chinese.*]—*Agric. sinica* **1** no. 9 pp. 273–317, 19 figs., 45 refs. Nanking, December 1935. (With a Summary in English.)

The following is taken from the author's summary of experiments in China on the influence of temperature and humidity on oviposition and hatching in the rice borer, *Schoenobius bipunctifer*, Wlk. Oviposition is only affected slightly by climatic conditions, but at a moderate temperature and humidity above 50 per cent. it takes place more readily. All the eggs are fully developed in the ovary at the time of deposition, and all may be laid within 3 or 4 days. The average numbers laid by a female were 136 for the overwintered generation at 23°C. [73·4°F.] in late May and early June, and 140 for the summer generation at 32°C. [89·6°F.] in late July and early August. As the short oviposition period renders it difficult to obtain the vital optimum merely on the number of eggs laid, the egg-laying ratio was determined as well. The maximum ratio was at 29°C. [84·2°F.] and 90 per cent. humidity. A hot rainy day is, therefore, the most favourable for oviposition. The maximum rate of hatching was at 27–31°C. [80·6–87·8°F.] and 85–100 per cent. humidity, and the maximum hatching percentage at 24–29°C. [75·2–84·2°F.] and 90–100 per cent. The optimum conditions for oviposition and hatching are 24–29°C. [75·2–84·2°F.] and 90 per cent. humidity. As the weather in August and September is an important

factor in the production of an outbreak in the following year [*cf. R.A. E.*, A **21** 179], it is probable that, if the weather is unsuitable in these months, an outbreak will not occur even if the winter is favourable to the insect.

VAN DER GOOT (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1934.** [Diseases and Pests of cultivated Plants in the Netherlands Indies in 1934.]—*Meded. Inst. PlZiekt.* no. 85, 94 pp. Buitenzorg, 1935. Price *Fl.* 1·25.

The pests observed in various parts of the Netherlands Indies during 1934 are briefly noted. The more injurious included *Aleurodicus destructor*, Mackie, and *Brontispa froggatti*, Sharp, on coconut; the white rice borer [*Scirpophaga innotata*, Wlk.] and yellow rice borer [*Schoenobius bipunctifer*, Wlk.] on rice; and *Stephanoderes hampei*, Ferr., and two Coccids [*Ferrisiana virgata*, Ckll., and *Pseudococcus citri*, Risso] on coffee.

COTTIER (W.). **Experiments on the Control of the Bronze Beetle** (*Eucolaspis brunnea*).—*N.Z. J. Sci. Tech.* **17** no. 2 pp. 433–453, 2 figs., 4 refs. Wellington, N.Z., November 1935.

In view of the fact that it has often been asserted that lead arsenate is of little or no value for the control of *Eucolaspis brunnea*, F., on apples in New Zealand, laboratory experiments, an account of which is given, were carried out during 1932–34 to test the effect of various sprays. The beetles were placed in cages containing treated fruit. In preliminary experiments in 1931 plum twigs were also used. The results showed definitely that acid lead arsenate poisons the beetles. The most important factor in protecting the apples is to obtain complete coverage [*cf. R.A.E.*, A **21** 67]. If a complete cover was not secured, a "spot" spray was better than a "mist" or a "drench" spray. Two sprays applied in quick succession gave better control than one, as did an increase in the concentration of the lead arsenate. Weight for weight, Paris green, Dutox (barium fluosilicate) and sodium arsenite were the only poisons that proved comparable with acid lead arsenate, and of these Paris green acted much more quickly than the others including lead arsenate. Dutox was about as efficient as acid lead arsenate. Calcium caseinate spreaders did not appear to increase the efficiency of the lead arsenate or Dutox. Oil protected the fruit if a complete cover was secured, but the amount that would have to be used would damage the fruit and would make the cost of spraying prohibitive. Oils at strengths of 1 : 40 or over appeared to increase the efficiency of acid lead arsenate. Lime-sulphur, precipitated sulphur, and Bordeaux mixture appeared to cause some mortality of the beetles.

CLARK (A. F.). **The Winter Moth** (*Hybernia indocilis* **Walk.**).—*N.Z. J. Sci. Tech.* **17** no. 3 pp. 541–549, 3 figs., 8 refs. Wellington, N.Z., December 1935.

In view of the damage caused to the needles of *Pinus radiata* and *P. muricata* by the larvae of the Geometrid, *Hybernia indocilisaria*, Wlk. (*indocilis*, Meyr.) in North Canterbury in the late summer of 1933, studies on its bionomics and control were carried out. Its systematic

position and all stages are described. It fed readily on various plants but appeared to prefer *Discaria tomatou*, which is probably its original food-plant. The infested area covered about 100 acres and supported a plant association including *Discaria*, which grew up to the bases of the trees.

The young larvae were not found feeding on any plant except *Discaria*, and experiments showed that the larva is not able to feed on pine needles until it has reached the third instar, that *Discaria* leaves are preferred to pine needles, and that the latter are only eaten when no other food is available. During the outbreak of 1933 the needles on all parts of the tree were attacked, and in most cases the trees were completely defoliated and growth was stopped. The infestation was confined to disconnected blocks of trees. The buds were not affected, and in many cases new foliage was formed after the outbreak ceased.

The adult females (which cannot fly) emerge as early as July and the males later. In the laboratory eggs were laid in small groups under débris or in crevices between stones at the base of *Discaria* plants. There are 3 overlapping generations in the field, larvae being numerous from September till the end of February. The first pupae were observed in September and October. All stages, except the egg, were found in the field. The maximum number of eggs laid by a female in the laboratory was 170. The egg stage lasted 9–15 days, and the total larval period 22–25 days when food was abundant. When fully-fed, the larvae drop to the ground and pupate under stones or débris. In spring and summer the pupal stage is completed in 15–20 days.

The injury in the late summer of 1933 was caused by the third brood larvae. A small outbreak occurred in the following spring but not on the same blocks of trees. In experiments, a proprietary calcium arsenate dust containing 40 per cent. arsenic pentoxide, applied at the rate of rather more than 0·6 oz. per tree, was sufficient to ensure the removal or destruction of all the larvae within a day. Much of the dust that was blown away by wind fell on the *Discaria* bushes and killed any larvae present on them. The outbreak was completely checked over the whole of the area by heavy frosts in early summer, and no further infestation has occurred. A series of seasons favourable to the insect and the inability of the *Discaria* to furnish the necessary food for the large number of larvae probably accounted for the outbreak.

Dumbleton (L. J.). *Apanteles tasmanica* **Cam. : A Braconid Parasite of Leaf-roller Larvae.**—*N.Z. J. Sci. Tech.* **17** no. 3 pp. 572–576, 10 figs., 2 refs. Wellington, N.Z., December 1935.

The species of *Apanteles* that was the most important parasite of *Tortrix postvittana*, Wlk., on apple in the Nelson area in 1931–32 [*R.A.E.*, A **21** 92] has been identified as *A. tasmanica*, Cam. The immature stages are described. Observations made in March and April during 1933–35 showed that it parasitised 30·2–51 per cent. of the larvae examined. It was reared in the laboratory on *T. postvittana*, and the adults were fed on honey solution. Pairing was not observed. The females appeared to be ready to oviposit 2 or 3 days after emergence. There were about equal numbers of males and females. As many as 4 eggs were laid in one host larva in the laboratory, but probably only 1 egg is deposited in each larva in the field. In no case was more than one larva reared from or found in one host larva. In May

1932 the incubation period was about 4 days. From 22nd March the incubation and larval periods up to the time of pupation occupied 37 days. In late April and early May the pupal period of 10 individuals averaged 24 days. Adult parasites emerged in mid-May when larvae were parasitised in the laboratory in mid-March. This is about 10 days less than the time taken for the production of a generation of *T. postvittana* at the same time of year. There are probably 2 or 3 generations of the parasite during the summer. It appears to overwinter in the overwintering larvae of the host. Larvae parasitised in early May contained first-instar larvae of the parasite 2 months later. Adults were observed in the field at the beginning of November. Hyperparasites reared from cocoons of *A. tasmanica* collected in the field were *Hemiteles* sp., which parasitised 15 per cent. in 1933–34; *Elachertus* sp.; and an unidentified Chalcidoid, which has parasitised 1–8 per cent. during the past 4 years.

FOWLER (R.). **Codling Moth Control Experiments, Blackwood, 1934–35.** —*J. Dep. Agric. S. Aust.* **39** no. 4 pp. 458–467, 2 figs. Adelaide. November 1935.

Experiments on the control of the codling moth [*Cydia pomonella*, L.] in South Australia [*cf. R.A.E.*, A **23** 163] during 1934–35 were designed to test the value of summer sprays as to efficiency, arsenical residues and cost. Four schedules on Cleopatra apples and one on Jonathans were carried out on plots containing 12 trees each. They were repeated on plots with 6–8 trees. All trees were banded, and bait traps were used on the main plots. Calyx sprays were applied when most of the petals had fallen, and the first cover spray 12–14 days later. Three further cover sprays were timed from the maximum emergence of the moths. Except where otherwise mentioned, the lead arsenate spray contained 4 lb. lead arsenate to 100 gals. water. A spreader was used with all lead arsenate sprays unless white oil was combined with them, and the white oil was at a concentration of $\frac{3}{4}$: 100 when mixed with another insecticide or 1 : 60 when used alone. The best control was obtained on Jonathan apples, which were given 2 sprays of lead arsenate and 3 of white oil. Infestation was 7·08 per cent. The variation in the effects of the 4 programmes used on Cleopatra apples was no greater than the greatest variation between two trees under the same programme. Control by the standard method with lead arsenate only (3 lb. instead of 4 lb. in the last 3 sprays) was least satisfactory, possibly because of the reduced concentration of arsenate. The lowest infestation (9·61 per cent. and 6·41 per cent. on main and duplicate plots, respectively) was given by 2 sprays of lead arsenate, followed by 2 sprays of white oil and lead arsenate (2 lb. to 100 gals.) and one of white oil and nicotine sulphate (1 : 1,600). Fruit of Cleopatras, but not Jonathans, was injured by oil spotting when oil was used for the last 2 or 3 cover sprays following lead arsenate.

The substitution of white oil for lead arsenate in the last 3 cover sprays reduced the arsenic residue on the fruit, but not below tolerance. The residue on the Jonathan apples was just on the limit (0·01 grains per lb.).

In bait trap experiments [*cf.* **23** 164], molasses proved more attractive than apple vinegar, catching an average of 62·66 and 40·75 moths per trap while vinegar caught an average of 18·08 and 5·7. Weekly counts from traps throughout the orchard showed that out of 2,040 moths

examined, 51·94 per cent. of the overwintered brood and 66·43 per cent. of the summer brood were females. The peaks of emergence of the two broods were on 26th November and 26th February. Late apples were badly infested. The fruit of the trees in which traps were placed was as much injured as that of trees without traps. It was found that bands treated with beta-naphthol [*cf.* **23** 163] did not repel larvae, since 462 were caught in the impregnated bands, and 337 and 303, respectively, in untreated bands placed above and below on the same tree. Treated bands should be removed and burnt at the end of the season, since their toxicity decreases and the larvae caught beneath them are not all killed. Such bands did not injure fairly old trees with rough bark.

NOBLE (N. S.). **The Gladiolus Thrips. Causes Growers severe Losses.** —*Agric. Gaz. N.S.W.* **46** pt. 12 pp. 681–682, 1 fig. Sydney, December 1935.

Taeniothrips simplex, Morison, has caused serious injury annually to *Gladiolus* in New South Wales since it was first recorded there in 1932. Feeding by adults and larvae produces a typical " silvering " of the foliage, and in severe infestations larval feeding within the developing flower spike may prevent the blooms opening. During the winter, all stages have been found on self-sown plants and in stored corms. The life-cycle lasts 2–6 weeks in the field, and 24–33 days in stored corms.

Thrips breeding in stored corms may be killed by storage with naphthalene flakes, treatment with a solution of mercury bichloride, or fumigation with hydrocyanic acid gas [*cf. R.A.E.*, A **23** 757, etc.]. At least two fumigations must be given, since the eggs are not destroyed. Experiments with a spray of 1 oz. Paris green, 2 lb. brown sugar and 3 gals. water [*cf.* **21** 466] have proved successful on the plants in the Sydney district. All self-sown *Gladiolus* should be destroyed between growing seasons.

MORGAN (W. L.). **The Tomato Mite** (*Phyllocoptes lycopersici*, **Tryon**). —*Agric. Gaz. N.S.W.* **46** pt. 12 pp. 683–684, 3 figs., 1 ref. Sydney, December 1935.

Since 1930 tomato crops in New South Wales have been seriously damaged by *Phyllocoptes lycopersici*, Tryon. The mites feed on the surface of the stems, fruit and foliage, and cause the blossoms to drop and the fruit to be stunted. Symptoms of infestation include silvering of the foliage and absence of epidermal hairs on the stems. Later the stems and lower surfaces of the leaves turn dingy brown, and the leaves wither and die except for the green shoots that appear at the base and the top of the plant. In the Sydney area, tomatos under glass are subject to severe damage in spring, but those grown in the open are chiefly infested from January to May. Infestation is most severe where planting extends over both spring and summer, or summer and autumn.

Sprays or dusts [*cf. R.A.E.*, A **23** 268] should be applied at least twice, when the fruit begins to ripen and a month later.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **46** pt. 12 pp. 685–688, 720, 4 figs. Sydney, December 1935.

The insect pests in New South Wales dealt with in this part of a series [*cf. R.A.E.*, A **24** 197] include *Agonoscelis rutila*, F., an indigenous

Pentatomid that is usually associated with horehound [*Marrubium*], but has recently been found in large numbers on *Citrus* and garden plants. It appears to do little damage, but a dust of 1 part derris to 9 parts talc, or of equal parts of pyrethrum powder and hydrated lime are suggested for control. A dust of 1 part lead or calcium arsenate and 3 parts lime or kaolin is more effective than a spray against *Epilachna vigintioctopunctata*, F., on potato, etc. [*cf.* **23** 201].

Nysius vinitor, Bergr., which increases rapidly on weeds in the spring, migrates to vegetable crops in early summer and subsequently to fruit trees, particularly stone fruits. It may be controlled by dusting with equal parts of pyrethrum and 2½ per cent. nicotine dust, but this is expensive, costing 1*s.* 3*d.* per lb. In the case of potato crops the bugs may be brushed into shallow troughs, about 6 ft. long and 2 ft. wide, which are filled with oil and water and drawn along between the rows. This measure should be repeated in the early mornings for several days in succession. Crops should be well watered, so that they can replace the sap removed by the insects. A lime dust may serve as a repellent on fruit trees, and smudge fires are also recommended. All infested weeds and grass in the vicinity should be sprayed with any strong oil emulsion or dusted with calcium cyanide. Fields may be protected by surrounding them with a straight-sided furrow with holes 1 ft. deep at intervals of 15 ft. The bugs tend to congregate in the holes, where they may be destroyed with oil. A line of creosote renewed daily along the top of the inside edge of the trench repels those that crawl up the side.

WRIGHT (J. A.). **Control of Fruit Fly. Experiments with White Oil—Nicotine Sulphate Spray.**—*Agric. Gaz. N.S.W.* **46** pt. 12 p. 689, 1 fig. Sydney, December 1935.

Following experiments in Queensland on the protection of apples from infestation by *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.) by means of a spray of white oil and nicotine sulphate [*R.A.E.*, A **23** 116], the same spray was tested on apples in New South Wales. Beginning on 27th December 1934, 10 applications (each of about 2 gals. spray per tree) were made at approximately weekly intervals to 24 trees distributed throughout an orchard. Poor weather conditions caused the apples to mature late ; normally only 5 or 6 sprays should be necessary. Counts made between 14th February and 20th March showed that on sprayed trees 28·2 per cent. of 5,326 apples were infested, and on 24 similar unsprayed trees 82·8 per cent. of 6,822 apples. Inefficient coverage of the trees owing to the use of a hand pump probably accounted for the high degree of infestation of the treated trees. The trees and fruit were not injured by the spray.

HALLER (H. L.) & ACREE, jr. (F.). **Constituents of Pyrethrum Flowers [I.] Determination of Pyrethrin II.**—*Industr. Engng Chem.* Anal Edn **7** no. 5 pp. 343–344, 12 refs. Easton, Pa, 15th September 1935. [Recd. January 1936.]

The following is the authors' summary : A rapid method for the determination of pyrethrin II, based on the fact that pyrethrin II yields methyl iodide when boiled with hydriodic acid is proposed. The methyl iodide is determined volumetrically by converting it into iodic acid and titrating with sodium thiosulphate the iodine liberated

on addition of potassium iodide. A comparison of the results obtained by the proposed method with values obtained by the acid methods shows that in all cases the new method gave values somewhat lower than the acid methods.

LaForge (F. B.) & Haller (H. L.). **Constituents of Pyrethrum Flowers. II. Isolation of Pyrethrin II.**—*J. Amer. chem. Soc.* **57** pp. 1893–1896, 6 refs. Easton, Pa, October 1935.

The following is the authors' summary : A procedure for the preparation of pyrethrin II is described. Petroleum ether extractives of pyrethrum flowers are separated from fats and waxes by the employment of acetic acid. The acids are removed from the concentrate by extraction in aniline solution with potassium carbonate. Partial separation of pyrethrin II from pyrethrin I is accomplished by taking advantage of their different solubilities in a system consisting of diluted acetic acid and petroleum ether. Pyrethrin II tends to concentrate in the acid solution, pyrethrin I in petroleum ether. Concentrates so obtained containing about 80 per cent. of pyrethrin II and about 6 per cent. of pyrethrin I are distilled in a molecular still and yield pure pyrethrin II.

Cupples (H. L.). **Wetting and Spreading Properties of aqueous Solutions. Oleic Acid - Sodium Hydroxide Mixtures.**—*Industr. Engng Chem.* **27** no. 10 pp. 1219–1222, 2 graphs, 6 refs. Easton, Pa, October 1935.

Sodium oleate is used extensively as a wetting and spreading agent. As a common soap it is used in sprays containing nicotine and in insecticidal dipping solutions. When used as both emulsifier and spreader in oil emulsion sprays, the sodium oleate is sometimes formed during the preparation of the spray by the interaction of oleic acid with sodium hydroxide. This procedure is convenient in practical spraying operations, but the possibility of thus obtaining solutions of inferior or variable wetting properties has not previously been raised. It is evident that in preparing a sodium oleate solution by causing oleic acid to react with sodium hydroxide, it will be relatively difficult to obtain an exactly neutral solution, or, rather, a solution containing equivalent amounts of alkali and fatty acid. In practical operations, it may also be necessary to make allowance for the acidity or alkalinity of the available water supply.

It has apparently been assumed that small departures from neutrality would not substantially alter the wetting properties, and the impression seems to be prevalent that a slight excess of alkali would probably improve the wetting and spreading properties. The work here reported shows that the wetting and spreading properties of aqueous solutions may be evaluated by determining their spreading coefficients with reference to a neutral mineral oil from measurements of the surface and interfacial tensions made with a du Noüy tensiometer. The significance of the spreading coefficients as a measure of these properties is demonstrated by a simple visual test. The wetting and spreading properties of aqueous mixtures of sodium hydroxide and oleic acid are very sensitive to variations in the ratio of alkali to fatty acid and may be adversely affected by a slight excess of alkali.

Soraci (F. A.). **Important Nursery Insects of New Jersey.**—*Circ. N.J. Dep. Agric.* no. 243, 62 pp., text-ill., 34 refs. Trenton, N.J., June 1934. [Recd. January 1936.]

This circular comprises information on some 50 important insect pests of trees, shrubs and ornamental plants in nurseries in New Jersey. Brief notes for each species are given on the general appearance of the various stages, the life-history, food-plants, type of damage caused and control measures.

McDaniel (E. I.). **Control of Iris Borer** (*Macronoctua onusta* **Grote**).—*Quart. Bull. Mich. agric. Exp. Sta.* **18** no. 2 pp. 92–94, 1 fig. East Lansing, Mich., November 1935.

In Michigan, *Macronoctua onusta*, Grote, overwinters in the egg stage on the leaves of iris [*cf. R.A.E.*, A **17** 718; **24** 66]. The larvae establish themselves in the rhizome about the end of June and excavate large cavities, which become infected with a bacterial rot caused by *Bacillus carotovorus*. The inside of the rhizome is reduced to a slimy rotten mass in which the borer thrives and which is particularly attractive to *Eumerus strigatus*, Fall. Of various insecticides applied about mid-August, when many of the larvae of *Macronoctua* had pupated and those of *Eumerus* were full-grown, calcium cyanide at the rate of 1 oz. per sq. ft. was the most satisfactory and gave a complete kill of both insects. No injury to the plants occurred when the rhizomes were covered with dry sand before the treatment. The best results were obtained when the calcium cyanide was covered with a light layer of sand as soon as it was applied.

Jones (H. A.), Campbell (F. L.) & Sullivan (W. N.). *Cracca*—**a Source of Insecticides. A preliminary Study of Domestic Species of Devil's Shoestring as Sources of insecticidal Materials.**—*Soap* **11** pp. 99, 101, 103, 105, 107, 109, 2 figs., 10 refs. New York, September 1935. [Recd. January 1936.]

The following is substantially the authors' summary: Chemical and insecticidal tests were made on 32 samples of *Tephrosia* (*Cracca*) collected in different parts of the United States. Of these samples, 27 were roots: 19 of *T. virginiana*, 3 of *T. lindheimeri*, 2 of *T. ambigua*, and 1 each of *T. latidens*, *T. hispidula* and *T. spicata*. The other samples consisted of aerial portions, hulls or seed pods, and seed of *T. lindheimeri*, and mixed seeds and pods of *T. virginiana* and *T. ambigua*. The collections represent 10 States from Texas to Maryland.

The following determinations were made on all or some of the 32 samples: Total acetone extractives, rotenone content, methoxyl content, optical rotatory power of acetone extract and Durham colour test. The relative effectiveness of kerosene and acetone extracts was determined against house-flies, the acetone extracts being tested by a method here described for the first time. The relative effectiveness of kerosene extracts was similar to that of the acetone extracts, and the latter was well correlated with the degree of blue-green colour given by the Durham test. By this simple test the effectiveness of a sample of *Tephrosia* can be roughly predicted. The insecticidal results were not well correlated with other chemical determinations. As only a few samples contained enough rotenone to permit its quantitative determination, data sufficient for comparison of rotenone content and

effectiveness were not obtained. Four samples of *T. virginiana* root from Texas and one of *T. latidens* from Florida contained from 0·2 to 0·5 per cent. rotenone.

The most effective samples of *T. virginiana* root came from Texas. Samples from the Carolinas, Virginia and Maryland were relatively ineffective. A sample of *T. latidens* root from Florida, one of *T. lindheimeri* root from Texas and seeds of the latter species were also highly effective. In spite of its lower content of toxic materials, it is believed that *Tephrosia* might be developed to an extent permitting competition with derris and cubé [*Lonchocarpus*].

Osburn (M. R.) & Lipp (J. W.). **Fumigation of Fresh Fruit to Destroy the Adult Japanese Beetle.**—*Circ. U.S. Dep. Agric.* no. 373, 29 pp., 18 figs., 9 refs. Washington, D.C., November 1935.

Details are given of the experiments on the fumigation of soft fruits with carbon bisulphide or ethylene oxide against adults of *Popillia japonica*, Newm. [*cf. R.A.E.*, A **18** 687; **20** 104, ; **22** 511], of the process under commercial conditions in New Jersey, and of the fumigating house used.

Green bananas taken by rail from the port of Philadelphia may be treated in the refrigerating wagon with hydrocyanic acid gas [*cf.* **22** 571]. All beetles are killed by exposure to 3 lb. calcium cyanide (50 per cent. cyanogen content) in a wagon of 2,600 cu. ft. capacity with an initial temperature of 80°F. for 1½ hours, or by 2 hours' exposure to 6 oz. liquid hydrocyanic acid introduced from a portable drum into containers in the ice compartments at each end of the wagon, the initial temperature being 75°F. Tests with a number of compounds or commercial products that produce HCN indicated that toxicity depends on the amount of gas and the rapidity of its evolution. Of 5 commercial products, those containing liquid HCN absorbed in diatomaceous earth or in wood-paper pulp were most effective. The amount of HCN absorbed by the bananas was not more than 10 parts per million, and practically all of this had disappeared after 5 days. A dosage of 5 lb. HCN in 1,000 cu. ft. injured the refrigerated fruit more severely than fruit transported in ventilated compartments. This was probably due to reaction between the moisture condensed on the surface of the bananas and the fumigation reagent. The cost per refrigerating wagon of the calcium cyanide and the hydrogen cyanide is about 10*d.* and 1*d.* respectively. Ethylene oxide caused severe injury to bananas.

Wilbur (D. A.). **Grasshopper Injury to the Inflorescence of Pasture Grasses.**—*J. Kans. ent. Soc.* **9** no. 1 pp. 1–12, 5 figs., 12 refs. McPherson, Kans., January 1936.

Widespread injury to the inflorescence of various grasses occurred in Kansas during the summer of 1932. The types of damage observed on different species of grass are described. It is considered almost certain that grasshoppers were responsible, although they were not seen feeding on the grass heads. In extensive collections made throughout the summer no other insects that could have caused the damage were taken. Grasshoppers are sensitive to drought and have injured grain in a similar way in hot summers [*cf. R.A.E.*, A **8** 314], probably in search of moisture. Climatic conditions in 1932, with high temperatures but sufficient rain to allow the grasses to develop, tended to make the

grasshoppers climb the stems of plants and shrubs to escape the heat. A list is given of 14 Acridids and 1 Tettigoniid of which the grasshopper population of the pastures was chiefly composed.

KUMPE (O.) & ISELY (D.). **Notes on Biologies of Nut-infesting Weevils.** —*J. Kans. ent. Soc.* **9** no. 1 pp. 13–16, 7 refs. McPherson, Kans., January 1936.

In studies in 1930–33, nuts and acorns were collected in north-western Arkansas, and weevil larvae emerging from them were placed on soil in flower pots to pupate and reared to the adult stage in the insectary.

Curculio caryae, Horn, which is of importance as a pest of pecan in the southern States, was reared from hickory (*Hicoria alba*). From limited observations, the life-cycle probably requires 3 years to complete, as all individuals passed 2 winters in the soil as larvae and a third as adults. This species is most frequently taken in the field during September. *Curculio auriger*, Casey [*cf. R.A.E.*, A **18** 113] was reared from chinquipin [*Castanea pumila*]. Its life-cycle lasts two years; it leaves the nuts in the autumn, passes the first winter in the soil as a larva and the second as an adult, and emerges in the following May or June. Adults were collected from catkins in early June. *C. pardalis*, Chittn., *C. baculi*, Chittn., *C. rectus*, Say, and an unidentified species near *C. parvidens*, Chittn., were reared from acorns. All pass the winter in the larval stage and have a life-cycle lasting either one or two years. None appears to be definitely associated with any one species of oak. The one year life-cycle was more common in *C. rectus* and the two year life-cycle in the other three species.

Conotrachelus naso, Lec., was reared from acorns in greater numbers than all the four species of *Curculio*. The larvae left the acorns and entered the soil between 1st October and 19th December, and the adults emerged from 4th May to 20th July in the succeeding year. They are active on oaks during the summer and begin to oviposit soon after the acorns form.

WALKER, jnr. (F. H.). **Observations on Sunflower Insects in Kansas.** —*J. Kans. ent. Soc.* **9** no. 1 pp. 16–25, 3 pp. refs. McPherson, Kans., January 1936.

This paper contains a list of insects observed on wild and cultivated sunflowers (*Helianthus* spp., mainly *H. annuus*) in Kansas during the summers of 1931 and 1932, with brief notes on the bionomics of the more important pests.

The eggs of the Nymphalid, *Charidryas nycteis*, Dbl. & Hew., hatched in about 9 days, and the first generation larvae appeared in late May or early June, when they were common on the leaves. The winter was passed in the pupal stage. About 70 per cent. of the larvae of the second and third generations were parasitised by *Apanteles hyphantriae*, Riley, which caused a decline in infestation later in the season. *Phorocera claripennis*, Macq., was also reared from the larvae. Predators attacking them included Vespids and Pentatomids.

The Cerambycid, *Zygogramma* (*Calligrapha*) *exclamationis*, F., which caused considerable damage to the foliage of isolated plants, has two generations a year, the second of which overwinters in the pupal stage. Eggs of the first generation were laid from 20th June to 15th

July on the leaves and stem of the terminal part of the plant and hatched in 4–5 days. The larvae fed on the leaves for about 16 days and then dropped to the ground and pupated at a depth of 1–3 ins. The adults emerged in mid-August, and almost immediately began to lay eggs for the second generation.

Adults of *Rhynchites aeneus*, Boh., which were observed from June to September, caused considerable injury to sunflowers in late summer by puncturing the stem 8-10 ins. below the flower so that it broke before the seeds were set. The punctures appeared to be for food only.

Dasyneura sp. deposited eggs in masses on the blooms while the ray flowers were green. There were 50–200 masses in a bloom and 7–9 eggs in a mass. Larval feeding at the base of the petals reduced the number of seeds. *Platygaster* sp. was reared from the eggs of this Cecidomyiid and *Rileya cecidomyiae*, Ash., and *Callimome coloradensis*, Huber., from the larvae.

Marshall (G. E.) & Hienton (T. E.). **Light Traps for Codling Moth Control.**—*Agr. Engng* **16** no. 9 pp. 365–368, 371, 8 figs. Ames, Iowa, 1935. (Abstr. in *Exp. Sta. Rec.* **74** no. 2, p. 234. Washington, D.C., February 1936.)

Studies in progress in Indiana are reported in which different electric lamps were employed to trap codling moths [*Cydia pomonella*, L.]. They indicate that the best position for a light trap is in a tree that carries a full load of apples, has a fairly broad top, and is higher than its neighbours. The trap should be at least a foot below the topmost foliage. The results of laboratory tests were similar to those obtained in the orchard, except in a few instances. In the laboratory, when only one light source was used, practically all the moths were attracted, one lamp being as effective as another, whereas in the field the ultraviolet sources attracted more moths than others tested. A photo-flood lamp of high light output proved to be the most attractive. An aluminium painted screen was of little value in making the light sources more attractive, and the lamps were not attractive enough to entice moths from the orchard 40 ft. away.

Brémond (P.), Jourdan (M. L.) & Règnier (P. R.). **Les punaises du blé.**—[*Publ.*] *Serv. Déf. Vég. Dir. gén. agric. Comm. Colon. Morocco*] no. 9, 2nd edn, 19 pp., 3 pls., 3 figs. Rabat, August 1935. [Recd. January 1936.]

A brief account is given of the bionomics of *Aelia triticiperda*, Pomel [*R.A.E.*, A **23** 292] and *Eurygaster austriaca*, Schr., which cause considerable damage to cereals, particularly wheat, in Morocco. *Eurygaster* also feeds, often preferably, on wild graminaceous plants (notably *Avena* and *Phalaris*), mallow [*Malva* sp.] and lucerne. All stages of both species are briefly described. *E. austriaca*, which is very similar to *A. triticiperda* in habits, differs from it in having only one generation a year [*cf.* **24** 189]. Overwintered adults appear in March or April and pair on the plants during the sunny part of the day. Oviposition begins 3–4 days after pairing and continues for 3–4 weeks, during which one female lays about 70 eggs in 5 batches. The average durations of the egg, nymphal and adult stages were 10 and 50 days and 10–11 months respectively. The nymphs have 5 instars and mature at harvest time. Soon afterwards the new adults shelter in cracks and

fissures in the soil and enter a diapause that lasts from about July to February.

The injury caused by the feeding of these bugs reduces the size, specific gravity, and gluten content of the grains and impairs their germinating power [*cf.* **23** 287, etc.]. The quality of the flour is depreciated, and when such flour is mixed, even in small amounts, with other flour the latter is also affected. Control measures consist in collecting the adults that appear in March or April either by hand or a net or by means of a simple apparatus, which is described (the bugs fall into scoops of netting and thence into a tin box, the whole being carried by a handle) ; and destroying the nymphs of the spring generation (if they are concentrated in small patches) by contact sprays, of which 1 lb. sodium arsenite in 10 gals. water is the cheapest and most effective. An emulsion of 1 gal. kerosene and 3 lb. soft soap in 4 gals. water is also effective and safer to use but more expensive. All the haulms left in the field after harvest should be burned, and this should be done in the morning or evening, as in the middle of the day the bugs shelter in cracks in the soil. Much damage can be avoided by growing early varieties of wheat, by harvesting infested crops as early and as quickly as possible, and by sowing patches of trap plants, such as *Avena* or *Phalaris*, to catch *E. austriaca*.

Notes on the precautions to be taken to prevent arsenical poisoning and the treatment of such cases in men or animals are appended.

Les Cochenilles farineuses nuisibles aux cultures arbustives et ornamentales.—*Memento Déf. Vég. Dir. gén. agric. Comm. Colon.* [*Morocco*] no. 33 8 pp., 3 pls. Rabat, August 1935. [Recd. January 1936.]

A brief account is given of the bionomics of *Pseudococcus citri*, Risso, *P. adonidum*, L., and *P. nipae*, Mask., 3 of the most important mealybugs attacking shrubs and ornamental plants in Morocco. *P. citri* and *P. adonidum* feed on 90 different species of widely varying food-plants, but *P. nipae* is rarely found except on exotic plants such as palms, *Musa*, etc. All stages of each species are briefly described, and their geographical distribution is discussed. Their life-histories are very similar ; reproduction is parthenogenetic, the males being rare or absent, and the generations follow each other at intervals of 30–40 days in summer. The winter is usually passed in the larval stage, though on the coast, where the climate is damp and warm, all stages are present throughout the year. The larvae hibernate in cracks in the bark, in ants' nests or on the large roots of the food-plants. They are sometimes found at a distance from the food-plant in galls formed by *Phloeothrips ficorum*, March., on ornamental *Ficus*. Natural enemies of the mealybugs in Morocco, which, although numerous, do not exercise adequate control over them, include various Coccinellids [*cf. R.A.E.*, A **23** 302] an undetermined species of *Leucopis*, the Hemerobiid, *Nefasitus fallax*, Nav., and the Tineid, *Batrachedra ledereriella*, Zell., the larvae of which feed on the wax covering of the egg-sacs of the females. *Cryptolaemus montrouzieri*, Muls., has been imported into Morocco and bred and released there for some years, but without much result, as the climate is unfavourable to it.

These mealybugs are extremely injurious, often causing the death of trees by complete defoliation, and the sooty mould that develops on the honeydew excreted by them sometimes interferes with the respiratory

processes of the plants. The only insecticide that has given satisfactory results on a practical scale is a strong (8 per cent.) kerosene emulsion, applied with force so as to penetrate the waxy filaments of the insects and the egg coverings. A list is given of 30 plants that have been sprayed with this emulsion without being scorched, and of a few others that have been injured by it.

Wilkinson (H.). **Progress Report on Coffee Mealy Bug.**—*Coffee Bd Kenya mon. Bull.* **1** no. 12 pp. 13, 16. Nairobi, December 1935.

Available information on *Pseudococcus lilacinus*, Ckll., and *P. kenyae*, Le Pelley, is summarised together with notes on further work to be undertaken in connection with the biological control of the latter on coffee in Kenya Colony. *P. lilacinus* has been recorded from Uganda, Tanganyika, Ceylon, Mysore, Malaya, the Netherlands Indies, and the Philippines, but it is doubtful whether all these records refer to this species. The mealybug that was recorded under this name in Kenya has recently been described as a new species, *P. kenyae* [*R.A.E.*, A **23** 607], which does not appear to occur as a serious pest of any crop in any other country. The larva of a Lycaenid feeds on so-called *lilacinus* in the Philippines and Ceylon. Internal parasites have only been found in Kenya with one doubtful record from Ceylon.

A consignment of *Coccophagus gurneyi*, Comp., which has successfully controlled *P. gahani*, Green, in California [**20** 594], *Tanaomastix* (*Leptomastidea*) *abnormis*, Gir., and a predacious Coccinellid, *Hyperaspis* sp., was received from California on 18th December 1934. Only *C. gurneyi* arrived alive. Adults of this Aphelinid, placed among colonies of *P. kenyae*, paired and laid numerous eggs in the mealybugs, but no larvae developed. *T. abnormis* is already present in Kenya parasitising *P. citri*, Risso, and no further attempt has been made to introduce it. Parasitised individuals of *P. kraunhiae*, Kuw., were received from Honolulu on 10th August from which 1 female parasite emerged. It was placed with the mealybugs but no young were obtained from it. Two consignments of several efficient Hymenopterous parasites and a predacious Cecidomyiid were received from Tanganyika at the end of September. The mealybugs that they attack are probably not *P. lilacinus*.

Bradley (J. C.). **Four new Species of** *Campsomeris* **(Hymenoptera : Scoliidae) from the Malagasy Subregion.**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 1. pp. 12–17. London, 15th January 1936.

Of the 4 Scoliids described, *Campsomeris minutalis*, sp. n., and *C. pocillator*, sp. n., from Madagascar, and *C. rodriguezensis*, sp. n., from Rodriguez Island, are being introduced into Mauritius for the control of Melolonthid beetles [*Lachnosterna smithi*, Arr.] attacking sugar-cane [*cf. R.A.E.*, A **22** 621]. *C. fax*, sp. n., is described from Mauritius, where it has been well-known for some time but has been misidentified as *C. rufa*, Lep. [**6** 141 ; **7** 5 ; **11** 135 ; **13** 491]. *C. rufa* was described from Spain and is identical with *C. ciliata*, F.

[Printz (Ya. I.).] **Принц (Я. И.).** *Phylloxera* **in Azerbaijan.** [*In Russian.*]—Demy 8vo, 111 pp., 4 figs., 9 graphs (3 fldg), 4 refs. Tiflis, Zakgiz, 1935. Price 2 *rub.* 50 *kop.*

This is a survey of investigations on *Phylloxera* in 1926–31 in north-western Azerbaijan, some of which have already been noticed [*R.A.E.*,

A **15** 372 ; **16** 607]. Only the root forms and the winged individuals derived from them were observed in the field. Dispersion is effected through planting material, tools, clothing and possibly wind, but chiefly by means of running water in the irrigation ditches. In experiments, all first-instar larvae survived 17½ hours submersion in water at 17–25°C. [62·6–77°F.] and 11 per cent. survived 120 hours submersion at 16·5–20·5°C. [61·7–68·9°F.]. For larvae of the 3rd and 4th instars the corresponding figures were 60 and 10 per cent., and all survived 3 hours' submersion. The five years' observations showed that there are 7 generations a year, activity being suspended from mid-October to about the end of April. Hibernation occurs on the roots near the surface of the soil, and the Aphids were never found on vine slips in winter unless they had been buried in the soil of infested vineyards. Intense migration of the larvae and transformation into nymphs takes place in July and August. The larvae do not migrate in damp soil. The distribution of infestation in different types of soil and the resistance of different varieties of vine are discussed. The best way of freeing slips or roots for planting from the Aphids was immersing them for 7 minutes in water at 44–55°C. [111·2–131°F.]. The chief measure for safeguarding vineyards from infestation should be the gradual establishment of vines grafted on American stocks. Fumigation of the soil with carbon bisulphide at the rate of 1·2 oz. per sq. yd., or with a mixture of 0·9 oz. carbon bisulphide and 0·3 oz. paradichlorobenzene or polychlorides [*cf.* **22** 77] per sq. yd. killed almost all the Aphids at different depths, carbon bisulphide being chiefly effective below a depth of 4 ins. and paradichlorobenzene and polychlorides in the upper soil layers. Fumigation should be carried out from about mid-October to about mid-November, or in April, against the overwintering larvae ; the vines should be dormant and the soil temperature at a depth of 4 ins. about 15–18°C. [59–64·4°F.]. The emergence of the larvae from the soil and transformation into nymphs was controlled in experiments by fumigating the soil in early July with a mixture of 0·6 oz. carbon bisulphide and 0·3 oz. paradichlorobenzene per sq. yd.

[Savenko (R. F.).] **Савенко (Р. Ф.). Liste des animaux invertébrés nuisibles aux plantes agricoles dans la Transcaucasie.** [*In Russian.*] Med. 8vo, 63 pp. 11 pp. refs. Tiflis, Izd. gruz. Fil. AN SSSR [Publ. Georgian Sect. Acad. Sci. USSR]. 1935. Price 6 *rub.*

This is a survey, based on the literature, of the invertebrate pests (chiefly insects) attacking field crops, orchards, vegetables and subtropical cultivated plants in Transcaucasia. A list is given of over 500 species under their orders and families, both Russian and scientific names being used, with particulars of the food-plants, distribution and corresponding literature. An extensive bibliography and an index to the Russian names of the plants are appended.

[Durnovo (Z. P.) & Pogodina (L. N.).] **Дурново (З. П.) и Погодина (Л. Н.). Results of Work on Pests of perennial Plants**—*Apocynum sibiricum*, **Ramie and others during 1931 and 1932.** [*In Russian.*]—*Bolyezni i Vredit. nov. lubyan. Kul'tur* [*Dis. Pests newly cultiv. Fibre Plants*] pp. 73–84, 10 figs., 1 ref. Moscow, Izd. Novlubinst. VASKhNIL, 1933. [Recd. January 1936.]

Notes are given on the bionomics of pests observed on cultivated *Apocynum sibiricum* in the north of the Kirghiz Republic and on ramie

[*Boehmeria nivea*] in western Georgia. The Sphingid, *Celerio* (*Deilephila*) *euphorbiae*, L., was the chief pest of *A. sibiricum*. It appeared to have three overlapping generations a year, all stages occurring simultaneously. The immature stages are briefly described. Eggs were found from the beginning of May to the end of September on the leaves of the food-plant. In the laboratory the egg stage lasted 3–9 days, and the larval stage averaged 26, 21 and 34 days for the three successive generations, respectively. The larvae attack the leaves and tops of the plants, often entirely defoliating them, and the yield and quality of the fibre is reduced. Pupation takes place in the soil; in the laboratory the prepupal and pupal stages lasted 2–7 and 14–18 days respectively. Pupae of the last generation hibernate. Up to 9·5, 4·5 and 4 per cent. of the pupae of the three generations were killed by fungous diseases, and 24·8 and over 20 per cent. of the pupae of the second and third generation were parasitised by Tachinids.

A Lamiid of the genus *Oberea* was next in importance as a pest of *Apocynum*. The adults, which were not observed, encircle the tops of the plants with deep punctures made for oviposition and perhaps feeding, causing the stems to break. The eggs are laid in the stems. In the field, the eggs and larvae were first found on the 23rd June. The larvae burrow in the bast and later in the xylem of the stems, and eventually make their way into the rhizome, in which they probably hibernate. Most of the damage was caused from mid-August to the end of September. Plants that had been cut at the end of May and were grown for the second crop were much less infested, only 8 per cent. breaking as compared with 34 per cent. of the uncut plants. Other pests included the adults of the Eumolpid, *Chrysochares asiaticus*, Pall., which caused considerable damage to the leaves, Aphids, which were injurious in one plantation, and *Tetranychus telarius*, L., which occurred in negligible numbers.

The chief pests of *Boehmeria nivea* were *Gryllotalpa gryllotalpa*, L., which destroyed 8–10 per cent. of the plants in nurseries in September; *Euxoa* (*Agrotis*) *segetum*, Schiff., which was active both in nurseries and in the field; the adults of the Halticid, *Podagrica malvae*, Ill., which fed on the leaves and young shoots, particularly in the first half of May; and *Loxostege sticticalis*, L. Other pests included the larvae of *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.), *Vanessa* (*Pyrameis*) *cardui*, L., and *V.* (*P.*) *atalanta*, L., and the adults of the weevil, *Baris timida*, Rossi.

[Durnovo (Z. P.).] **Дурново (З. П.). Results of Work on the Maize Moth and other Pests of newly cultivated Annual Fibre Plants.** [*In Russian.*]—*Bolyezni i Vredit. nov. lubyan. Kul'tur* [*Dis. Pests newly cultiv. Fibre Plants*] pp. 85–106, 4 figs., 3 graphs. Moscow, Izd. Novlubinst. VASKhNIL, 1933. [Recd. January 1936.]

Notes based on observations in 1931 and 1932 in North Caucasus, Daghestan, Georgia and in the north of the Kirghiz Republic are given on insects infesting *Hibiscus cannabinus*, *Abutilon avicennae* and hemp (*Cannabis sativa*), with lists of the species concerned, showing their distribution. Of those found on *H. cannabinus*, the Halticid, *Podagrica malvae*, Ill., caused considerable damage to seedlings in Georgia in the beginning of May. In North Caucasus *Euxoa* (*Agrotis*) *segetum*, Schiff., injured 8–10 per cent. of the seedlings in some localities, *Loxostege sticticalis*, L., caused serious damage in one plantation in June,

and wireworms (*Agriotes* sp.) destroyed in spring up to 30 per cent. of the plants in fields that had recently been under grass, though fields that had been cultivated for several years were only slightly infested. *E. segetum* was also injurious in Kirghizia.

Of the pests of hemp, the Halticid, *Psylliodes attenuata*, Koch, which was the most injurious, was abundant on the seedlings in North Caucasus. In Daghestan, *E. segetum* destroyed the seedlings, and the Tenebrionid, *Opatrum sabulosum*, L., was active in May, especially in fields that adjoined waste land covered with weeds. *Mordellistena parvula*, Gyll., was abundant in North Caucasus and Kirghizia; in the latter region it caused most damage in late July and early August, infesting 95 per cent. of the early sown hemp and 66–78 per cent. of that sown in April and May.

The chief pests of *A. avicennae* in North Caucasus were wireworms and *Podagrica malvae*. *Heliothis armigera*, Hb. (*Chloridea obsoleta*, F.) occurred on the plants from the beginning of August till harvest in October, 18–35 per cent. of the bolls being infested. The larvae of *Carcharodus althaeae*, Hb. [*cf. R.A.E.*, A **24** 17] fed on the leaves till mid-June and again in September and early October. In the laboratory the pupal stage in June lasted 8–13 days. Adults observed in early September laid their eggs singly, chiefly on the upper surface of the leaves. The Geotrupid, *Lethrus apterus*, Laxm., and the larvae of cutworms and wireworms were injurious in Kirghizia. *O. sabulosum* attacked up to over 23 per cent. of the plants in Daghestan in fields with wide spacing between the rows.

Special attention was devoted to *Pyrausta nubilalis*, Hb. In North Caucasus larvae found in the stems of stacked hemp and *H. cannabinus* pupated between 10th May and 20th July, and adult emergence began on 20th May, and reached a peak in the second half of July. Larvae were abundant in cultivated fields from mid-June, and adults of the first generation emerged from the beginning of August till mid-September. There was a partial second generation. The damage caused by *P. nubilalis* in the Caucasus and Kirghizia to *H. cannabinus*, *A. avicennae*, hemp, and other fibre plants is discussed; *A. avicennae* was the least attacked. The infested plants are stunted or wither and die, and a large percentage of the stems break. The severest infestation occurred in North Caucasus, and the lowest in Kirghizia. In North Caucasus up to 6 per cent. of the stubble harboured overwintering larvae. Maize was decidedly preferred to any of the fibre plants or to sunflowers; of the weeds, a species of *Amarantus* was the most infested. Brief recommendations for control include cutting the plants close to the ground at harvest, autumn ploughing and destruction of crop residues and weeds that may harbour overwintering larvae, and prohibition of the use of stems and crop remnants for thatching, etc.

Lipp (H.). **Die Lebensweise von** *Melasoma aenea* **(L.) in der Mark (Col. Chrysomelid.).** [The Biology of *M. aeneum* in Brandenburg.]—*Dtsch. ent. Z.* 1935 no. 1–2 pp. 1–64, 35 figs., 1 pl., 20 refs. Berlin, 21st December 1935.

The only detailed observations on the biology of *Melasoma aeneum*, L., recorded are those of Keller in Switzerland [*R.A.E.*, A **9** 613], which do not apply to North Germany, where this Chrysomelid has only one generation a year. In this paper is given as complete as

possible a description of the adult and larval biology in nature in Brandenburg as well as of observations in the laboratory. The immature stages are described. Both adults and larvae feed on the leaves of the black alder, *Alnus glutinosa*, almost exclusively, though *A. incana* is attacked if available. The damage done is negligible.

Schädlingsbekämpfung durch " Degesch " Verfahren. [Pest Control by Fumigation with Hydrocyanic Acid Gas and Ethylene Oxide.] Demy 16 mo, 90+34 pp., illus. Frankfurt a. M., Deutsche Ges. Schädlingsbekampf. (Degesch), 1936.

This little pocket book is issued by the German corporation producing hydrocyanic acid gas and ethylene oxide for fumigation against pests. The pests against which these fumigants are used in Germany are briefly described with short notes on their biology, and information is given on the various points connected with fumigation with hydrocyanic acid gas and ethylene oxide. The latter is always used in combination with carbon dioxide.

Hejtmánek (J.). **Allgemeine Biologie der Wachsmotte.** [General Biology of the Wax Moth (*Galleria mellonella* L.).] [*In Czech.*]—*Sborn. Vyzk. Ust. Zem.* no. 128 pp. 23–46, 4 figs., 40 refs. Prague, 1935. (With a Summary in German.)

This is an account, based on the literature and personal observations, of the bionomics and control of *Galleria mellonella*, L., an important pest of apiaries in Czechoslovakia. The characters distinguishing it from the smaller wax moth, *Achroia grisella*, F., which occurs less frequently and is much less destructive, are described. When occurring together, the larvae of *G. mellonella* often destroy those of *A. grisella*. In the field the moths are on the wing from March to November and oviposit 2–3 days after pairing. The eggs are laid on the floor of the bee-hives, in cracks and on the combs. The duration of the egg stage depends on temperature ; at 35°C. [95°F.] the eggs hatched in 5–6 days, but at 40°C. [104°F.] they were killed in 12 hours, though the larvae were not. Eggs laid in the autumn outside the hives hibernate. The larvae burrow through the combs under cover of silk tunnels which protect them from the bees [*cf. R.A.E.*, A **18** 485] ; they also destroy the broods, all instars being attacked, or dislodge them. The spinning glands are described. The optimum temperature for larval development is 35°C. ; and 10°C. [50°F.] is the critical limit. Larvae exposed up to 8 times to temperatures of between 1°C. and −6°C. [33·8–21·2°F.] for 12 hours at a time became torpid, but when placed at 35°C. revived within 2 hours and developed normally. Further exposures to the same low temperatures, however, produced paralysis. Larvae exposed twice for 12 hours to −12°C. [10·4°F.] outdoors also survived. Less resistance was shown to high temperatures, as 45°C. [113°F.] produced paralysis in 12 hours and at 50°C. [122°F.] the larvae soon died. Under favourable conditions the larvae mature in 21 days and pupate in white oval cocoons fixed to the wooden parts of the hive in smooth cells which they gnaw out in the wood. The pupal stage lasts 14 days or more. Wax alone seems to be insufficient for the nourishment of the larvae, and to complete development they need the addition of nitrogenous matter, which they find in the remains of the cocoons of the bee pupae. In experiments, larvae fed for different periods on

wax only showed greatly retarded development. Those that were given a normal diet after 56 days began to grow rapidly, and gave rise to normal adults, but one that was fed on wax only died on the 96th day. The store of pollen may be used to compensate for lack of nitrogenous matter. In special experiments, 5 days old larvae fed exclusively on pollen for 12 days developed normally and pupated. Young larvae fed on excreta of the preceding generation, or on stearine, larval cocoons, glucose or saccharose died and older ones gave rise to very small moths [*cf.* **23** 367].

The possibility of the larvae spreading diseases among bees was demonstrated. The excreta of larvae fed on a comb infested with spores of *Nosema* contained the spores and a high percentage of bees fed on them became infected. In similar experiments with *Bacillus alvei* and *B. larvae*, excreta from infected larvae sown on agar produced spores and vegetative forms of both bacilli.

The larvae of *G. mellonella* are parasitised by *Eupelmus cereanus*, Rond., *Microbracon hebetor*, Say, and *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), which also attacks pupae, and the eggs by *Trichogramma evanescens*, Westw. Bats and birds destroy the adults, but natural enemies do not exercise any appreciable control.

The maintenance of strong colonies of bees is the best means of preventing infestation, since it is the weak ones that are attacked. Combs that might be infested may be fumigated with sulphur before being placed in the hives or stored ; the stored combs should be kept in boxes with tightly fitting lids, and periodically examined.

[**Order concerning Importation of Plants into Jugoslavia.**]—2 pp. typescript. *Official Gazette* no. 5274/11. Belgrade, 3rd February 1936.

This announcement for 1936 is similar to that for 1935 [*cf. R.A.E.*, A **23** 510]. Belgium is added to the countries infested with *Leptinotarsa decemlineata*, Say, and the Hawiiaan Islands to those infested with *Aspidiotus perniciosus*, Comst.

The Narcissus Pests (Cornwall) Order of 1935.—*S.R.O.* 1935 no. 1328 3 pp. London, 28th December 1935.

This Order, which comes into operation on 1st February 1936, empowers officers appointed by Local Authorities to examine any narcissus plants or bulbs on any premises in Cornwall and to require the occupier to treat them in any prescribed manner if they are infested with *Merodon equestris*, F., *Eumerus strigatus*, Fall., or *E. tuberculatus*, Rond.

The Cabbage Aphis (Bedfordshire, Cambridgeshire and Huntingdonshire) Order of 1936.—*S.R.O.* 1936 no. 120 3 pp. London, 21st February 1936.

This Order, which comes into operation on 1st March 1936, empowers officers appointed by Local Authorities to examine crops of cabbage, turnip or other crucifers of the genus *Brassica* in Bedfordshire, Cambridgeshire and Huntingdonshire between 15th February and 30th June in any year, and to require the occupier to treat the crop in any prescribed manner if it is substantially infested with the cabbage aphis (*Brevicoryne brassicae*, L.).

Jary (S. G.) & Austin (M. D.). **Department of Entomology** [Report 1934–35].—*J. S.E. agric. Coll.* no. 37 pp. 9–14. Wye, Kent, January 1936.

Brief notes are given on the work carried out and the insect pests observed in south-eastern England during 1934–35. *Macrosiphum* (*Myzus*) *festucae*, Theo., which is usually uncommon, was widespread on winter oats throughout the southern half of England. The plants, which showed large purple blotches on the leaves in March and April and finally became brown and shrivelled, were completely destroyed over large areas where this Aphid was numerous. Serious destruction of grasses observed for some years near Hastings was associated with the presence of *Crambus* spp., and of a Coccid, *Eriopeltis* sp., which was abundant in large patches over most of the affected fields. *Phorbia* (*Chortophila*) *brassicae*, Bch., was widely distributed and injurious on radish during dry weather in July, especially in lighter soils, and in one case was found mining in the midribs of swede leaves and in the crowns of the plants.

The eggs of *Cydia pomonella*, L., one of the outstanding pests of apples, were laid a good deal later than usual, and most larvae entered the side of the fruit. The loss was very much greater than in any previous year. *Hoplocampa testudinea*, Klug, the emergence of which was disturbed by frost on 17th May, was much less prevalent than usual at the normal time, but some of the sawflies emerged later and oviposited in apples already beginning to develop, so that attacks of some severity occurred on trees where eggs had been very scarce at the time of examination. A very high incidence of parasites of *Anthonomus rubi*, Hbst., was observed in Sussex, although the injury caused to strawberries was of normal intensity. Few parasites had been obtained there in previous years. Of several hundred infested buds collected in 1935, 50 per cent. yielded the parasite, *Microbracon* (*Bracon*) *immutator*, Nees, which had been sent from Devon where it had been bred from *A. rubi* several years previously. Young hops in one district were severely injured by the Tortricid, *Cnephasia pascuana*, Hb., which had not previously been recorded on hops. The larvae cut a deep furrow in the tip of the bine and occasionally made a longitudinal tunnel, killing off the tip. Newly-budded roses were damaged in Surrey by the Cecidomyiid, *Thomasiniana oculiperda*, Rübs., which also infested buds of ornamental crab-apple and cherry. A study has been begun on *Rhynchites aequatus*, L., and *R. coeruleus*, DeG., which attack apple, and *R. germanicus*, Hbst., which occurs on strawberry.

Evans (A. C.) & Martin (H.). **The Incorporation of Direct with Protective Insecticides and Fungicides. I. The Laboratory Evaluation of Water-soluble Wetting Agents as Constituents of Combined Washes.**—*J. Pomol.* **13** no. 4 pp. 261–292, 2 pls., 4 figs., 33 refs. London, December 1935.

The following is the authors' summary : For the purpose of selecting for field use the most promising of the numerous wetting-out agents, detergents and other products now available as " spreaders " in combined washes, a laboratory method for the determination of spray retention is described. This method has been applied to the evaluation of the wetting and spreading properties of aqueous solutions of these materials and to the examination of the suitability of the physical

characteristics of area of spread and contact angles upon standard surfaces and of surface tension as criteria for the evaluation of wetting and spreading properties. The detergents, wetting-out agents and other materials of possible value as "spreaders" are classified on a structural basis and analytical data of those selected for the preliminary trials are recorded. Wetting properties are defined by the ability of the liquid to form a persistent liquid-solid interface when excess of liquid is drained from the surface. A high correlation is shown between the wetting properties and the receding contact angle of the spray. Perfect wetting results when this angle is zero. Spreading properties are defined by the ability of the liquid to form a liquid-solid interface solely by surface activity over the plane surface of a solid, and are, for the time being, distinguished from penetrating properties which determine the creep of the liquid through a porous solid. Spreading properties may therefore be assessed by the estimation of the area of spread. The maximum amount of spray initially retained upon the standard plane surface held rigidly at right angles to the direction of the spray is determined by both the wetting and spreading properties of the spray for that surface, and shows a marked decrease with increase of wetting and spreading ability. The area of spread is determined by the advancing contact angle, but in solutions of similar advancing contact angle examined, is greater with spreaders of long-chain structure. The receding and advancing contact angles of the solutions examined exhibit a high degree of correlation, with the exception of saponin solutions. There is accordingly justification for the use of the equilibrium contact angle but, for reasons given, it is considered advantageous to regard the advancing and receding angles as distinct entities. The various physical properties examined, namely, spray retention, area of spread, contact angles and surface tension, all arrange the materials tested in the same rough general order of activity. Except in the case of the correlations mentioned above, the determination of any one characteristic is insufficient to give a general assessment of wetting and spreading properties. The results obtained suggest, however, that with materials of similar molecular structure, it may be possible to deduce generalisations upon behaviour as a spray spreader and wetter from a limited number of laboratory-determined characteristics.

HENIN (S.). **Quelques propriétés physico-chimiques concernant les liquides insecticides et anticryptogamiques.**—*Rev. Path. vég.* **22** pt. 3 pp. 209–216, 3 refs. Paris, 1935.

In this paper some physico-chemical properties of liquids (pure liquids, suspensions and emulsions) including surface tension, wetting properties, viscosity, fluidity and plasticity are defined. Brief descriptions are given of methods of determining these qualities.

RAUCOURT (M.), DUPOUX (R.) & DUPOUY (J.). **Nouvelles observations sur l'entraînement des poudres insecticides par le vent.**—*Rev. Path. vég.* **22** pt. 3 pp. 217–221, 1 ref. Paris, 1935.

In further experiments in France on the amount of arsenical dust from potato fields dusted against the potato beetle [*Leptinotarsa decemlineata*, Say] that is blown by the wind into adjoining fields, the dust was collected on sheets of glycerined paper [*cf. R.A.E.*, A **21**

398]. Error in analysis probably accounted for the lower deposit of arsenic when bird-lime was used on the paper instead of glycerine. The dust contained 66 per cent. calcium arsenate, 19 per cent. calcium carbonate and 15 per cent. clay. The arsenic (As) content was 20·2 per cent., while the dusts usually employed against the potato beetle contain 10 to 13 per cent. and are applied to give 2–2·5 kg. arsenic per hectare [about 2 lb. per acre]. When 20–23 kg. dust was applied per hectare [about 18–20 lb. per acre], an increase of about 200 per cent. in the wind velocity (from 1·6 to 4·5 miles per hour) caused a decrease in the arsenic deposit per square metre on the field itself, and an increase of about 100 per cent. (from 7·0 to 13·5 mg. per sq. m.) at a distance of 16·4 ft. from the field. An increase to 44 kg. per hectare [40 lb. per acre] of dust applied scarcely increased the arsenic deposit outside the field. Such deposits were chiefly caused by dusting the outside rows of the plots. At a distance of 66 ft. from the field deposits were very small and varied little either with the amount of dust applied or with the velocity of the wind.

Choremi (G. I.). **Un nouveau moyen pour préserver les plants de la courtilière.**—*Rev. Hort. Agric. Afr. N.* **40** no. 1 p. 16. Algiers, January 1936.

The practice of protecting plants against the mole cricket [*Gryllotalpa gryllotalpa*, L.] with collars of reeds is widely used in Greece. Tests were made on fields of tomato and egg-plant [*Solanum melongena*] as to the efficacy of the bark of oleander [*Nerium oleander*] used in this way. The bark was removed easily from shoots one or two years old, and placed round the seedlings, which were planted out immediately, before the bark dried. The bark allowed the plant free growth. The loss of protected plants was 3 per cent. and of unprotected plants 20–30 per cent. Since very thin pieces give protection, the chemical nature of the bark probably repels the crickets.

Hamilton (A. G.). **The Relation of Humidity and Temperature to the Development of three Species of African Locusts**—*Locusta migratoria migratorioides* (**R. & F.**), *Schistocerca gregaria* (**Forsk.**), *Nomadacris septemfasciata* (**Serv.**).—*Trans. R. ent. Soc. Lond.* **85** pt. 1 pp. 1–60, 26 figs., 2 pls., 44 refs. London, February 1936.

These experiments, all of which were carried out on the *transiens* phase of the above three species, were designed to determine the factors influencing their life-cycle in different climates, with special reference to the effect of humidity and temperature on sexual maturation and diapauses.

The locusts were kept in glass tanks, 15 × 15 × 20 inches, and heat was supplied by electric heaters controlled by thermostats. Humidities below 45 per cent. were obtained by suspending in the cages wire gauze containers filled with silica gel (SiO_2) treated with cobalt nitrate, which changed colour on absorption of moisture and acted as an indicator; estimates of humidity were made with Edney paper hygrometers and a hymatograph. Hoppers were supplied with fresh green food, but that given to adults was partly dried. For ordinary breeding, the floor of the cages was covered with 3–4 inches of sand; in experiments, the cage had a false floor of perforated zinc, and tubes filled with sand for deposition of individual egg-pods were inserted in it.

Humidities are given in terms of relative humidity and not as saturation deficiency, as it was found that the latter did not explain the reactions of locusts to air with different moisture contents, different results being obtained under conditions of practically identical saturation deficiency, but different temperatures.

The following is largely taken from the author's summary. The successful development of any stage of the life-history depends on a suitable combination of temperature and humidity, the optima differing for each species and for each stage. The incubation period of eggs at suitable humidities decreases with a rise of temperature ; the minima were 8 days at 110°F. for *Locusta*, 12 days at 100°F. for *Schistocerca*, and 24 days at 100°F. for *Nomadacris*. It is essential for eggs that cannot absorb moisture from a humid atmosphere to be in contact with particles of water during the early stages of development.

Experiments on hoppers showed that the lowest constant temperature at which complete development takes place is 80°F., and with suitable humidities the rate increases with the temperatures. The optimum for *Locusta* is 90–110°F. ; for *Schistocerca* the upper limit is somewhat lower, and for *Nomadacris* the lower limit is slightly higher. Optimum humidities are 50–75 per cent. for *Locusta* and *Nomadacris*, and 50–70 per cent. for *Schistocerca*, which is less tolerant of extremes. Below and above the optimum humidities, the rate of hopper development decreases, the adverse effect of extreme humidities increasing with a rise of temperature and varying with the species. At 80°F. and 25 per cent. humidity neither *Schistocerca* nor *Locusta* hoppers can survive, although they are able to do so at 35 per cent. ; at 90°F. *Schistocerca* cannot survive 35 per cent. humidity, at which *Locusta* reaches the adult stage. At 100°F. development is not possible below 45 per cent. humidity for either species. For *Locusta* the inhibitory high humidity was 95 per cent. at 90° and 100°F. ; for *Schistocerca* it was 80 per cent. The inhibitory low relative humidities for *Nomadacris* are 30 per cent. at 80°F. and 40 at 100°F.

For the highest percentage of hoppers becoming adult, the optimum humidities approximate the optima for the maximum rate of development ; the most favourable temperature is about 90°F. Hoppers are more adversely affected by extreme conditions in the first than in subsequent instars.

Adults of *Locusta* did not reach sexual maturity at 35 per cent. humidity and 80–90°F., but could do so at 40 per cent. and 100°F. [*cf. R.A.E.*, A **20** 97] and up to 85 per cent. at 90°F. In *Schistocerca*, the lower limits are 40 per cent. at 90° and 45 at 100°F., while 80 is the upper one. *Locusta* reared at optimum humidity and transferred to dry conditions on reaching the adult stage, reached maturity at 25 per cent. humidity at 90°F., showing that the conditions in which hoppers are reared affects the state of the germ cells at the time of adult emergence. The requisite conditions for *Nomadacris* approximate those for the other species. The rate of sexual development increases as temperature rises from 80 to 100°F. in *Locusta* and from 80 to 90°F. in *Schistocerca* ; in *Nomadacris* sexual maturation cannot occur below 90°F., and at 100° is only reached if the diapause has not been interrupted in the previous generation.

The sectioning of testes showed that humidity was a very important factor in controlling the quantity of spermatozoa produced. Pairing cannot occur unless sperm bundles occupy 64 and 74 per cent. of each testicular tube in *Locusta* and *Schistocerca* respectively. The spermatic

fluid has a stimulating effect on the development of ovaries, for unfertilised females mature more slowly than the fertilised ones. The greatest fecundity (number of egg-pods per female) was at 60–75 per cent. humidities for *Locusta* and 50–60 per cent. for *Schistocerca* ; the optimum temperature for both was 90°F.

The more rapid the sexual maturation, the shorter the length of adult life. At optimum humidity and 80°F. *Locusta* and *Schistocerca* survive for 179 and 198 days respectively ; at a low humidity and 90°F. *Schistocerca* could live for 261 days.

There is no general rule with regard to the diapause in the adult stages, for *Locusta* can be bred without one for an unlimited number of successive generations at optimum humidity and temperatures of 90–100°F., and even if maturation is prevented by unfavourable conditions, the adults die off at normal age. In *Schistocerca* the diapause is not obligatory, for it can be bred for four successive generations under favourable conditions, but in dry conditions the adults can remain without maturing for 128 days, and still retain their ability to do so on being transferred to suitable humidity. In *Nomadacris* it is possible to break the diapause, which normally occurs in nature, in every alternate generation only, for when it was broken in two successive generations, the eggs deposited were not viable. It is, however, possible to shorten the diapause and obtain two complete generations a year.

Butler (C. G.) & Innes (J. M.). **A Comparison of the Rate of Metabolic Activity in the Solitary and Migratory Phases of** *Locusta migratoria*.—*Proc. roy. Soc.* (B) **119** no. 814, pp. 296–304, 3 figs., 11 refs. London, February 1936.

The possible physiological differences between phases *solitaria* and *gregaria* of *Locusta migratoria migratorioides*, R. & F., were investigated by means of accurate measurements of their oxygen consumption with a specially devised Barcroft apparatus. The technique employed is described, the oxygen uptake being measured per unit time and per unit area of body surface.

In the individuals of the first instar there is no significant difference between the phases, but both males and females of ph. *gregaria* in all the other instars show a higher rate of metabolism than the corresponding instar and sex of ph. *solitaria*. The metabolic rate in the males, in all the instars and both phases, appears to be higher than that of the females. There is a marked falling off in the rate of oxygen uptake per unit area of body surface from the first instar to the third, after which the rate increases.

Roonwal (M. L.). **The Growth-changes and Structure of the Egg of the African Migratory Locust,** *Locusta migratoria migratorioides*, **R. & F. (Orthoptera, Acrididae).**—*Bull. ent. Res.* **27** pt. 1 pp. 1–14, 5 figs., 46 refs. London, February 1936.

The following is taken from the author's summary : The eggs of *Locusta migratoria migratorioides*, R. & F., increase in size during development owing to the absorption of water from the soil. The wet weight of a freshly laid egg is about 0·0063 gm., and the water content 52 per cent. ; in fully developed eggs the wet weight is 0·014 gm. and water content 82 per cent. The dry weight decreases from 0·003 to 0·0024 gm. The structure of the egg-wall is described.

Smee (C.). **Notes on the Red Locust** (*Nomadacris septemfasciata*, **Serv.) in Nyasaland 1933–34.**—*Bull. ent. Res.* **27** pt. 1 pp. 15–35, 12 figs., 1 map, 4 refs. London, February 1936.

Detailed field observations have been made on *Nomadacris septemfasciata*, Serv., ever since it invaded Nyasaland early in 1932. The females, which apparently oviposit repeatedly, preferred to lay on cleared cultivated ground, where up to 40–50 egg-pods were found per square foot. Incubation lasted about 30 days, and the hatching, which is described in detail, took place from early morning till noon. Newly hatched hoppers devour the vermiform larvae, and if on bare ground, move about actively until they reach vegetation, in which they then congregate. Under normal conditions, the hoppers show negative geotropism, collecting in the evening on tree-trunks up to 30 ft. from the ground. In long jungle grass the movement of bands is not continuous, but if the hoppers are moving forward with considerable impulse and come to a cleared patch, the temperature of the soil may cause them to move across it without stopping. Such a movement may take a band through a clean-weeded maize garden without any damage being done. Young hoppers did not march before the air temperature in the sun reached 82°F. The distances travelled are variable, a band probably covering 6 miles during development. The larval period lasted from 64 to 86 days in cages, and averaged 73 days in the field. The rate of development was slowest at higher altitudes, which at that season are hotter and drier than the lowlands and in which in 1934 the larval period lasted from January till May.

During the earliest flights, the adults drift intermittently, parts of a swarm settling down and taking off again and the whole travelling 2–10 miles a day. The true migrating flights, which may cover a distance of 60 miles, are more purposeful and directive, but the density and vertical range of the swarms are very variable. The taking off of a swarm, which does not begin to fly until shade temperature had reached 80°F., is usually preceded by vibration of wings. Generally a swarm proceeds across the wind rather than with it.

The young adults that developed in Nyasaland in April 1933 vacated those areas below 2,000 ft. in which the rainfall from May to October was less than 0·1 in. and the mean maximum temperature rarely fell below 80°F., and tended to concentrate in hilly areas with 2·5 to 5·0 ins. of rain during the dry season. With the approach of the rains in November, the lower elevations were re-invaded from the hills ; and during the breeding period, the swarms were massed in areas having a rainfall up to 35 ins. between November and April. The tendency to vacate low-lying areas was again apparent early in 1934, although the continuation of the rains into the normally dry months caused the swarms to remain quiescent for considerable periods and somewhat equalised the conditions in the plains and the hills.

These facts and a comparison by means of climatographs of locust activity with temperature and relative humidity, indicate that the coincidence of a maximum temperature above 80°F. and humidity below 60 per cent. stimulates sustained flight as opposed to indefinite circling, and suggest that humidity is one of the factors determining the movement of swarms during the dry season. The return of flights to vacated areas coincided with a rise of humidity to or above 60 per cent.

Mermithid worms were found in immature adults, and both adults and hoppers were parasitised by Sarcophagid and Tachinid flies, the

rate of parasitism being higher in 1934. Occasional predators of hoppers included Reduviids and a Tettigoniid, *Acanthoplus speiseri*, Brancs. The fungus, *Empusa grylli*, was first noticed in February 1934 and later developed throughout the Protectorate, causing considerable mortality in adults and hoppers. A comparison of rainfall in various areas where the fungus developed showed that apparently about 15 ins. of rain in some 30 days out of a 60-day period is sufficient to start the disease as a controlling factor. To determine whether the disease could be effectively propagated by spraying the swarms with spore suspension, the latter was sprayed over agar-covered glass slides, while control slides were placed among infected hopper bands. In the latter case the average deposition reached up to 259 spores per sq. cm., while heavy spraying with a suspension of spores obtained from 100 hoppers and diluted with 4 gals. water gave only 23 per sq. cm. It is concluded that such large numbers of diseased insects would have to be collected to prepare an effective spray that this method would be impracticable.

Maxwell-Darling (R. C.). **The Outbreak Centres of** *Schistocerca gregaria*, **Forsk., on the Red Sea Coast of the Sudan.**—*Bull. ent. Res.* **27** pt. 1 pp. 37–70, 6 figs., 2 pls., 3 refs. London, February 1936.

An ecological description is given of the Red Sea coast of the Sudan, where the author made field studies in the winters of 1933–34 and 1934–35. The coastal plan can be divided into parallel belts, and the sand dune belt near the coast, where the khors or beds of seasonal rivers form deltas, and which is characterised by an abundance of *Suaeda* bushes, was the most important in the ecology of *Schistocerca gregaria*, Forsk. The rainy period occurs in winter and is very variable in duration. Cultivated areas of bulrush millet (*Pennisetum typhoideum*) and of watermelons occur in the *Suaeda* belt, south of latitude 20°N., usually in or adjoining the khors, and it is in these that the outbreak centres were found.

Counts in the field showed that the maximum number of *solitaria* individuals were found in the cultivated areas, where incipient outbreaks were observed during the winter seasons of 1933–34 and 1934–35. The concentration of locusts was due to the fact that the soil in the areas of millet consists of soft sand that retains moisture and offers ideal egg-laying sites if the dry surface sand is blown away by the wind. In addition, the millet and the weeds growing among it remain green longer than plants on the surrounding areas ; on soft soils the common weed, *Heliotropium undulatum*, which is preferred as a food-plant, and consequently acts as a concentrating agent for hoppers, is practically evergreen.

From detailed field observations in an outbreak centre in the winter of 1934–35, it is concluded that the chief factor determining the commencement of an outbreak is heavy winter rainfall (over 240 mm. [9·45 ins.] during the season) lasting from the end of October till the end of February and allowing for the development of two successive generations. If the old adults, which have passed the summer in an immature condition, mature and oviposit in November, owing to the early commencement of the rains, their progeny, hatching from the end of November, reaches the adult stage in January and matures and oviposits in March. The hoppers of the second generation, appearing in March–April, concentrate on *Heliotropium* bushes (which

remain green), assume *congregans* colouration and give rise to swarms which migrate in May. The reason for the rapid maturation of the young adults of the winter generation is not clear, but cage and field observations suggest that a short period of very high humidity is effective, and that rainfall, with accompanying high humidity, is necessary for oviposition.

The beginning of the outbreaks in the Sudanese area in 1925–26 [*cf. R.A.E.*, A **14** 571] and 1912 coincided with heavy winter rainfall on the Red Sea coast.

Other outbreak areas are likely to exist along the coast of Eritrea, south of the Sudanese border, and on the Arabian coast of the Red Sea. In fact, all parts of the sea-coasts of Africa and Asia that have a winter rainfall reaching 240 mm. and extending for a period sufficiently long to allow for the development of two successive generations must be under suspicion of harbouring outbreak areas.

MAXWELL-DARLING (R. C.). **A short Reconnaissance of Northern Darfur (Anglo-Egyptian Sudan) with regard to** *Schistocerca gregaria*, **Forsk.**—*Bull. ent. Res.* **27** pt. 1 pp. 71–76, 1 map. London, February 1936.

A short tour was made in Northern Darfur in the autumn of 1934, to investigate the ecology of *Schistocerca gregaria*, Forsk. The country traversed is described and illustrated by a map. Darfur is no more suitable for *Schistocerca* than Kordofan [*R.A.E.*, A **22** 262] and had a scanty population of *solitaria* individuals. It appears that the two conditions necessary to start an outbreak, *viz.*, the production of two successive generations in a season and a concentration of hoppers [*cf.* preceding paper] are lacking in Darfur, for the young adults, which appear in September, have no time to reach maturity before the beginning of the dry season in October, and the conditions in the "gozes" (sandy hills) and "gizzu" (loose sand areas), where the locusts occur, are too uniform to produce any concentration.

KEY (K. H. L.). **Observations on Rate of Growth, Coloration and the abnormal Six-instar Life-cycle in** *Locusta migratoria migratorioides*, **R. & F.**—*Bull. ent. Res.* **27** pt. 1 pp. 77–85, 4 figs., 9 refs. London, February 1936.

The following observations were made on isolated individuals of *Locusta migratoria migratorioides*, R. & F. (ph. *solitaria*), kept under moist or dry conditions at a constant temperature (27°C. [80·6°F.]) and light intensity. The relative humidity in one case varied from 99 per cent. to saturation, and in the other between 5–10 per cent., rising to 50 per cent. for a few hours every day. The average weights of the instars were calculated from weighings made at all periods within them. In hoppers kept at saturation the figures did not show accurate doubling of weight from stage to stage, the progressive factor being in excess of two. The percentage rate of growth between the mid-points of successive stages was of the same order for all pairs. Already in the third instar the females were on the average 50 per cent. heavier than the males. The larval period lasted 38 days, the first three instars being of the same length, the fourth and fifth progressively longer.

Hoppers kept in dry conditions were much lighter than those kept in wet, but the durations of the instars were longer, the total larval period

lasting 56·8 days. The percentage rate of growth was just half that of hoppers kept at high humidity.

About 85 per cent. of hoppers kept in humid conditions became green by the fourth instar, but the colouration of hoppers kept in dry air showed resemblance to black and white backgrounds [*cf. R.A.E.*, A **20** 672]. An extra larval instar (either an extra third or fourth) that appeared in all the females from two particular egg-pods is considered to be due to an inherited factor.

Uvarov (B. P.) & Hamilton (A. G.). **Phase Variation and Rate of Development in the Algerian Race of the Migratory Locust** (*Locusta migratoria*, **L.**).—*Bull. ent. Res.* **27** pt. 1 pp. 87–90, 2 refs. London, February 1936.

The Algerian race of *Locusta migratoria*, L., although not known to occur in the gregarious phase in nature, can be readily transformed into almost typical ph. *gregaria* by breeding in crowded cages. The biometric measurements of such individuals indicate the relationship of the Algerian race to the palaearctic subspecies *migratoria*, L., rather than to the tropical subspecies *migratorioides*, R. & F., but further data are necessary for a final decision. The rate of embryonic and hopper development in the Algerian race is the same as in *migratorioides* bred under the same conditions, but sexual maturation is very much slower.

Uvarov (B. P.). **The Oriental Migratory Locust** (*Locusta migratoria manilensis*, **Meyen 1835**).—*Bull. ent. Res.* **27** pt. 1 pp. 91–104, 2 maps, 18 refs. London, February 1936.

The oriental form of *Locusta migratoria*, L., occurring in south-eastern Asia, the Malay Archipelago and the Philippine Islands, is compared biometrically to the other subspecies of *Locusta* and is separated as *Locusta migratoria manilensis*, Meyen, which is nearest to the palaearctic subspecies *rossica*, Uv. & Zol., and *migratoria*, L. [*cf. R.A.E.*, A **18** 55]. The available information on the outbreaks of this locust in China [*cf.* **23** 46; **24** 4], North Borneo, the Philippine Islands, the Netherlands Indies, Formosa [*cf.* **21** 550], and Malaya [*cf.* **3** 467; **4** 426], is reviewed, and the available data on outbreak areas are discussed.

The occasional and permanent breeding areas in China are illustrated by a map. The latter are mostly situated in dry sandy areas, with sparse vegetation and subject to extensive flooding, in otherwise semi-arid country, and provide a striking analogy with the outbreak areas of the subspecies *migratoria* in Central Asia [*cf.* **17** 2] and *migratorioides* in French West Africa [*cf.* next paper and **22** 708].

The probable outbreak areas in the Philippines, Borneo and Malaya represent a new type, for here the locust inhabits countries with a very humid tropical climate, originally covered with forests, where normally there is no chance for the development of the gregarious phase. The required conditions have been created by the primitive methods of agriculture [*cf.* **23** 407]. The clearing of forests led to the extension of grasslands, while the practice of burning grass and using the land until it is thoroughly impoverished created habitats overgrown by *Imperata* and eminently suitable for locusts. Moreover, owing to the rapid growth of tropical vegetation, such areas must be subject to great

fluctuations, often resulting in the crowding of locusts in a small space and consequent transformation into the gregarious phase. Other suitable areas for breeding of locusts in Malaya are provided by abandoned tin mines and rubber plantations. It is stressed that the locust problem in Pacific countries can only be solved by detailed ecological studies on the spot.

LEAN (O. B.). *Locusta migratoria migratorioides*, **R. & F. : An Ecological Reconnaissance of the suspected Middle Niger Outbreak Area.**—*Bull. ent. Res.* **27** pt. 1 pp. 105–184, 9 figs., 1 map, 3 pls., 19 refs. London, February 1936.

This reconnaissance of the suspected middle Niger outbreak area of *Locusta migratoria migratorioides*, R. & F., was made in the summer of 1932. Very detailed descriptions are given of the river system, orography, climate and vegetation in the area surveyed. The whole country from Sansanding to Timbuctoo is a plain broken by occasional hills and covered by an anastomosis of irregular channels and lakes, liable to be flooded in high water. The annual variations in the river régime are discussed, and an analysis is made of climatic conditions during the years preceding the last outbreak of *Locusta*. The vegetation in the inundation zone shows a regular zonation, ranging from strand, through grassland, to parkland and desert.

Locusts of the solitary phase occurred only in the inundation area, where they were confined to open grassland, within which they showed a marked preference for the zone characterised by the stands of *Vetiveria* that mark any slight ridges ; they were also common in dense *Cyperus* associations, which, however, are flooded early during inundations and are unsuitable for oviposition. Both these plants often escape destruction by fire, and afford green food for locusts throughout the year, as well as a retreat from predators, of which the bee-eater, *Merops nubicus*, is the most important. The *solitaria* individuals probably become concentrated in these habitats by the end of the dry season, but have a wider range during the rains. Studies on the distribution of population by means of counts, also showed that a rising lake drives hoppers inshore, thus supporting the author's contention that flooding may assist the development of phase *gregaria* by reducing the size of the habitat and inducing forced activity.

The breeding activities of ph. *solitaria* were studied ; in 1932 the generations were rather indefinite and overlapped, but in the south-western part of the inundation area two successive generations were produced between June and September. Biometrical and colour analyses of the specimens collected there, in the vicinity of Diafarabé, have shown that in May the locust population consisted mainly of phases *solitaria* and *dissocians*, while in September the *solitaria* were outnumbered by phases *congregans* and *gregaria*, for the specimens were larger than those with corresponding elytron-over-femur ratios in May. An attempt is made to show graphically the difference between the May and September populations and locusts from flying swarms by plotting the absolute measurements of elytra and femurs, and a hypothetical complete phase graph is constructed on this basis. The characters of the various phases, in particular those that may be used in practice for distinguishing ph. *congregans* from *dissocians* are given. The ph. *congregans* was only observed in September in Diafarabé, in the generation that had developed under flood conditions.

Since the first swarms of *Locusta* reported in West Africa in 1928 [*cf. R.A.E.*, A **19** 709 ; **21** 32] were of considerable dimensions, the transformation of ph. *solitaria* into ph. *gregaria* must have commenced earlier. In 1926 in the southern area, the rains set in unusually early, and were abnormally heavy, while the middle rains were below the average. In the *Vetiveria* plain the *solitaria* population probably commenced to oviposit in May. Abundant precipitation would favour simultaneous hatching, and there would be plenty of food. The floods were low, leaving exposed areas, so that the locusts could breed without interruption, building up the material to form ph. *congregans*. Similar climatic and flood conditions occurred in 1927, intensifying the tendency towards *congregans*, and incipient swarms had probably congregated by August 1927. In 1928 the first generation of hoppers collected into definite bands, which gave rise to flying swarms in July.

It is concluded that the actual outbreak centres are situated, not on the edge of the inundation area, as believed by Zolotarevsky [**22** 708], but in the *Vetiveria* plains, on its intermediate levels ; these are most extensive in the vicinity of Diafarabé, where the maximum flood coincides with the hopper period, and where the first hopper bands were reported in 1928.

The paper includes records of swarms and hopper bands of ph. *gregaria* observed during the survey ; comparisons of the direction of flight with those of wind show that although most swarms flew with the wind, the general movement after July was towards the north-east, the swarms moving irrespective of the wind so long as its force was not above 12 miles per hour.

ROUBAUD (E.). **Recherches expérimentales sur le Criquet Pélerin. II. La livrée hibernale et les migrations réactivantes de la phase grégaire.**—*Bull. Soc. Hist. nat. Afr. N.* **26** no. 8 pp. 272–278, 2 refs. Algiers, November 1935.

Experiments with *Schistocerca gregaria*, Forsk., have shown that the adults cannot long support temperatures of from −5° to +10°C. [23–50°F.], but are very resistant to daily fluctuations ranging from −3° to 55°C. [26·6–131°F.], which induce a diapause in sexual maturation and in general make the locusts more vigorous.

When newly-moulted rose-coloured adults were subjected to drought and low night temperatures, in the course of a few weeks they assumed a darker red tint, such as is found in locusts hibernating in nature, and here called the winter colouration. This colour they retained from October to January under the daily temperature fluctuations of the experiment. Consequently, red-coloured individuals need not necessarily be the newly moulted ones, but may have undergone a winter diapause in maturation. This supports the suggestion that in French Africa there are two separate populations of *Schistocerca*, one north and one south of the Sahara [*R.A.E.*, A **22** 564], each producing one generation a year. According to this theory, the dark red adults that arrive in southern Algeria in December–January had hatched in Algeria in the previous spring and had migrated to the hibernation zones, probably situated on the slopes of the Saharan mountain massifs. That they are not the swarms produced in summer in the Sudan zone [*cf.* **23** 637] is suggested by the occasional marked discrepancy between the number of swarms observed in the Sudan zone and those arriving in Algeria. Moreover, if it is assumed that locusts produced in northern

Africa immediately undertake a long migration to the Sudan zone, it is not clear why the generation produced in the latter should not at once proceed to northern Africa, for the temperatures prevailing at the time of its appearance are still high enough to enable it to do so.

A second generation in a year may be occasionally produced when separate swarms fail to reach the hibernating zone, or leave it too early, and it is these that provide the permanent population in the outbreak areas. It is urged that the discovery of the hibernating zones is as important as the discovery of the outbreak centres.

Frappa (C.). **Etude sur la sauterelle migratrice** *Nomadacris septemfasciata* **Serv. et sa présence à Madagascar de 1926 à 1935.**—*Bull. écon. Madagascar* N.S. no. 3 pp. 203–221, 32 refs. Tananarive, 1935.

The literature on the synonymy, general distribution and biology of *Nomadacris septemfasciata*, Serv., is reviewed, and the records of this species from 1926 in Madagascar are given. The solitary individuals are widely scattered, but the first swarm ever seen in Madagascar, in March 1934, and the hopper band and swarm observed in March–April 1935 were recorded in the humid areas near the upper and middle courses of the great rivers in the south-western part of the Island. The colouration and biometrical measurements of solitary and swarming individuals were studied, and the latter were concluded to belong to ph. *gregaria*. There is one generation per annum, eggs being laid in November–January, and hoppers occurring from February–April. So far *Nomadacris* has not been known to damage cultivated plants in Madagascar, but this is probably due to its confusion with *Locusta migratoria capito*, Sauss. The usual control measures are discussed.

Ramchandra Rao (Y.). **A Note on the Locust Position in North-West India and Baluchistan during the Current Year 1935.**—*Curr. Sci.* **4** no. 5 pp. 325–326. Bangalore, November 1935.

Rainfall was plentiful in Baluchistan in the winter and spring of 1934–35, and *Schistocerca gregaria*, Forsk., began to breed in February, the adults of the new generation appearing in April in the coastal areas. These apparently migrated inland, and their progeny appeared in the hinterland of Mekran in June and July.

In the middle of July there was a sudden increase in the number of locusts along the Mekran coast, in Upper Baluchistan, Sind, south-western Punjab and western Rajputana. The locusts, which differed biometrically from the already present *solitaria* population, presumably come from a western source by an imperceptible immigration of individuals, and in a few cases, of small swarms. A similar incursion took place in that area in 1926, when, owing to heavy summer rains, the immigrants gave rise to abundant progeny which started the last locust cycle in India. In 1935, summer breeding began in July, but owing to the general failure of the rains, the new generation appearing in September was not numerous and consisted mostly of the *solitaria* phase.

Tammes (P. M. L.). **Treksprinkhanen in Nederlandsch-Indië.** [Migrating Locusts in the Netherlands Indies.]—*Landbouw* **11** pp. 114–122, 2 figs., 7 refs. Buitenzorg, 1936.

In 1932 and 1935, as well as on other occasions, swarms of *Locusta migratoria manilensis*, Meyen (*migratorioides*, auct.) were observed on the islands of Celebes and Halmahera. Their origin must be looked for in the southern part of the Philippines, where the locusts always appear in the years in which they are recorded in northern Celebes; moreover, they are first noted in the small islands lying between Celebes and the Philippines.

Breeding has not been recorded with certainty, and owing to the scarcity of suitable areas would not present any great danger. Afforestation of any areas suitable for breeding is recommended as an effective means of control.

Bouet (G.). **Recherches et Travaux de la Mission française en A. O. F. Etat actuel du problème des Acridiens migrateurs en Afrique.**—*Rev. Bot. appl.* **16** no. 173 pp. 1–27, 20 refs. Paris, January 1936.

A general review, based on data from the literature, is given of the recent ecological research on locusts in Africa, with special reference to the work carried out in French West Africa under the auspices of the Algerian Committee for the Study of Locust Biology [*cf. R.A.E.*, A **22** 327, 703, 704, 708, etc.].

Smit (B.). *Lentula obtusifrons* **Stål, the beneficial Rhenosterbos Locust.**—*S. Afr. J. Sci.* **32** pp. 461–468, 2 figs. Johannesburg, November 1935.

The rhenosterbos bush, *Elytropappus rhinocerotis*, is annually becoming more troublesome in Cape Province, South Africa, and many farms are thickly overgrown with it. Stock will not eat it, and it is useless except for fuel. Apparently it spreads where the veldt has been overstocked with merino sheep. Cutting it out has been fairly successful in some cases, but is expensive. Following an outbreak of *Lentula obtusifrons*, Stål, which killed many bushes near Grahamstown in 1931 a study of this Orthopteron was begun in 1932. On several farms where the bush was very dense the insects began to kill it during 1930, and by 1934 large patches of the bush had been completely killed. By October 1933 all the bushes over an area about 4 miles long and 2 miles wide on one farm were dead and grass was growing over all the area. Two unsuccessful attempts were made to establish the insect in another locality. Its distribution and the condition of the bushes in the Eastern Province are shown in a table. It appears to cause little mechanical injury to the bushes and does not defoliate them. It feeds on the growing tips of the shoots, eating back the side shoots first and then the main shoots for about $\frac{1}{2}$ in. Exhaustive experiments have failed to confirm the view that it transmits a disease that kills the plants.

Mating was observed on bushes on the veldt during January. In the insectary eggs were laid in fairly soft damp soil, about 1 inch deep. The packets were enclosed in a hard shell and one contained 46 eggs. The incubation period varied from 149 to 277 days according to the time of year. It was difficult to rear the insects in captivity, and only

those in cages built over bushes growing in the sun matured. From 12 nymphs that hatched on 28th November 2 males and 4 females matured in 11–12 weeks and the rest died. The adults lived in the cage until the end of May but no eggs were laid. There were at least 5 instars. From 10 nymphs placed in a similar cage 1 adult male was obtained after 138 days. The total developmental period was about 9 months and the adults lived about 3½ months. There is thus apparently one generation a year, but in the field the eggs are deposited and hatch at irregular times and the stages overlap.

The insects are attacked by the locust fungus [*Empusa grylli*] and by birds, especially guineafowls. It appears, however, to be impractical to breed them in large numbers for liberation, as they are difficult to rear and dependent on natural conditions when liberated.

La fourmi des jardins *Tapinoma simrothi* **Emery.**—*Memento Déf. Vég. Dir. gén. Agric. Comm. Colon.* [*Morocco*] no. 34, 8 pp., 1 pl. Rabat, October 1935. [Recd. January 1936.]

Notes are given on the habits of *Tapinoma simrothi*, Krausse, in Morocco, and all stages and the construction of the nest are described. The workers foster Aphids and Coccids, and feed on the honeydew they produce. If this is not available, they invade dwellings in search of fruit and preserves, or sever the shoots of young plants to obtain the sap. They are omnivorous, but show a marked preference for sweet liquids. Preventive measures in dwellings include keeping food in wire safes and the use of repellents such as carbolic acid, and mixtures of lime and naphthalene or beech creosote and kerosene. The nests may be destroyed by pouring boiling water or an oil emulsion into them or by introducing carbon bisulphide and heaping up the earth to prevent the gas from escaping. Other methods of destroying the ants are dusting with sodium fluoride in places frequented by them and the use of poison baits. A syrup consisting of 100 oz. sugar, 2½ pts. water, 0·1 oz. tartaric acid, 0·1 oz. sodium benzoate and 0·3 oz. sodium arsenite is recommended. The workers carry this syrup into the nest, where the queens and larvae feed upon it so that a whole population may be destroyed. Precautions to be observed in preparing the baits and methods of treating cases of poisoning in man or animals are outlined.

DE JONGHE D'ARDOYE (E.). **Note sur la bruche de l'arachide** *Pachymoerus acaciae* **Gill.**—*Bull. Ann. Soc. ent. Belg.* **75** pt. 11–12 pp. 421–422, 2 figs. Brussels, 31st December 1935.

Brief notes are given on the bionomics of *Pachymerus acaciae*, Gyll., which infests ground-nuts [*Arachis hypogaea*] and has spread from Asia to Greece, Italy and the north and west coasts of Africa. In 1925, the percentage of infested ground-nuts arriving in France from French West Africa was very small, but by 1933, 12 out of 13 shipments showed more than 25 per cent. infestation.

The life-cycle of this Bruchid is completed in 2–3 months at 30–35°C. [86–95°F.]. Up to 60 eggs are laid on the pod of the ground-nut, beginning 46 hours after emergence. The larvae hatch in 8–15 days and penetrate the pod directly beneath the egg, to feed on the seeds. They mature in 2 months and after cutting a hole in the pod from the

inside, pupate within it. Occasionally cocoons are spun outside and between several nuts.

Fumigation with chloropicrin destroyed the Bruchids, but the oil from ground-nuts so treated was three times as acid as that from untreated ones. Trioxymethylene gave good results when applied in a partial vacuum, and even in large warehouses that were poorly ventilated. Ground-nuts should be fumigated before export since infestation spreads and much injury may be done before arrival in Europe.

Sagot (R.) & Bouffil (F.). **Etudes sur la bruche de l'arachide** (*Pachymoerus acaciae*).—*Bull. Com. A.O.F.* **18** no. 1 pp. 79–91. Paris, 1935. [Recd. January 1936.]

An account is given of observations in French West Africa in 1933 and 1934 on the infestation of ground-nuts [*Arachis hypogaea*] by the Bruchid, *Pachymerus acaciae*, Gyll. The seeds are stored in the dry season in warehouses, which are then kept completely empty until the next consignments arrive. Nevertheless, the latter often show immediate signs of infestation by adult Bruchids. These have apparently survived by hibernating in the larval or cocoon stages, as in experiments they never lived more than 50 days as adults. The authors substantiated this theory of reinfestation by placing soil from the floor of an infested warehouse in a glass jar covered with screen wire on 8th August 1934. Living Bruchids were found in this jar on 27th September and adults of a second generation appeared on 8th December, uninfested pods of *A. hypogaea* having been placed in it in November. Tests to discover the manner in which the Bruchid develops in a field sown with infested seed gave inconclusive results. It was shown in insectary tests not to be specific to *A. hypogaea*, though it bred freely only in tamarind fruits. Infested pods were also found on tamarind plants growing in the field. It is therefore suggested that natives in villages should be made to burn tamarind seeds, which are commonly thrown away in the course of preparing certain dishes and may constitute a source of infestation.

At harvest the ground-nut plants are pulled up, and after they have dried, the seeds are tied up in small cotton bags. On 20th December, or 50 days after the small bags had been filled, Bruchids were found in some of them. This shows that Bruchids may be brought to the warehouse with the harvested crop. Observations in 1933 showed the pupal period to last 18–21 days. In 1934 the pupal stage in tamarind pods lasted 28 days in September and early October, the prolongation being probably due to the winter season. Two sizes of exit holes were also noted in the pods, the larger being those made by the adults and the smaller those of larvae that left the pods to pupate outside.

Fumigation of infested pods with carbon bisulphide at the rate of 1 fl. oz. to 5 cu. ft. gave complete control. It is recommended for the treatment of warehouses and sacks after the seed has been brought in. Paradichlorobenzene mixed with the pods was found to reduce the reproductive power of the Bruchids, though it did not kill all the adults. When coarsely chopped and mixed with the stored pods, *Datura* [*cf. R.A.E.*, A **23** 204], and to a less extent *Malpighia alternifolia*, greatly reduced the multiplication of the Bruchids and apparently of other insect pests.

NOTLEY (F. B.). **New Method against a Coffee Pest. Pyrethrum Powder to kill** *Antestia*.—*E. Afr. Standard* 10th Jan. 1936 reprint 1 p. Nairobi, 1936.

Preliminary experiments on the use of very finely ground, undiluted pyrethrum powder against *Antestia* and *Lygus* [*coffeae*, China] on coffee in Kenya have given promising results. In tests on caged trees, 5 gm. powder per tree (about 7½ lb. per acre of 600 trees) killed 100 per cent. of *Antestia*. A field test on 400 trees reduced the average numbers of *Antestia* per tree from 72·2 to 0·97. A block of 1,600 trees was divided into 16 parts, 8 of which were left as control plots. The average infestation was 23·3 *Antestia* and 11·2 *Lygus* per tree. The other 8 plots were dusted in duplicate with about 2, 4, 6 and 8 lb. pyrethrum per acre. In each case, the dust killed a slightly higher percentage of *Lygus* than *Antestia*. The percentages killed by 6 and 8 lb. per acre were 71·0 and 94·2 respectively of *Antestia* and 89·4 and 95·6 of *Lygus*. The amount of dust applied should vary with the size and condition of the trees and it should be distributed evenly over each tree. It appears probable that dusting may be carried out even when the trees are wet with dew or rain. The use of a suitable carrier might reduce the amount of pyrethrum necessary and give more efficient coverage. The dust is applied by a converted hand sprayer ; the necessary alterations, which can be made fairly simply, are described. The treatment is quicker than spraying with kerosene extract of pyrethrum [*cf. R.A.E.*, A **21** 265] and costs 5*s.* 6*d.* per acre, or about half as much.

MOUTIA (A.). **Entomological Division.**—*Rep. Dep. Agric. Mauritius 1934* pp. 25–26. Port Louis, 1935.

Hand collection of adult beetles at night is still employed in Mauritius against *Lachnosterna* (*Phytalus*) *smithi*, Arrow, the parasites of which, *Tiphia parallela*, Smith, and *Campsomeris* (*Elis*) *thoracica*, F., were not very common in 1934, possibly owing to severe drought. As a result of a search for parasites in Madagascar, 39,000 examples of *Campsomeris pilosella*, Sauss. [*cf. R.A.E.*, A **23** 345], and 500 of a Tachinid were introduced and have been colonised and liberated in various infested centres. *Nomadacris septemfasciata*, Serv., was very rare and did little damage to sugar-cane, the mynah bird, *Acridotheres tristis*, being common in localities previously infested by this locust. Pupae of *Wohlfarhtia euvitatta*, Villen. [*cf.* **23** 68] were received from Pretoria but no adults emerged. Most cane plantations, particularly those in low-lying and dry districts, were severely attacked by *Diatraea venosata*, Wlk., which was favoured by the drought, the reduction in crop reaching 62–75 per cent. in some fields. Sporadic outbreaks of *Oryctes tarandus*, Ol., occurred in cane plantations particularly affected by drought in the southern part of the Island.

A few examples of the Braconid, *Opius phaeostigma*, Wlkn., received in a further consignment from Pretoria [*cf.* **23** 68] for use against *Dacus d'emmerezi*, Bezzi, and *D. ciliatus*, Lw., on cucurbits are under observation. Sweetened lead arsenate bait-sprays gave good results against these flies. Outbreaks of *Prodenia litura*, F., and *Spodoptera mauritia*, Boisd., occurred in various localities, but their attacks were not severe in the hot and dry areas. Poisoned bait made up of sliced cactus and sodium fluoride gave good results against these cutworms.

GARTHWAITE (P. F.). **Entomological Research.**—*Rep. Silv. Ent. Burma 1934–35* pp. 59–66. Rangoon, 1936.

In experiments with *Xyleutes ceramicus*, Wlk. (bee-hole borer) on caged teak trees [*Tectona grandis*] in Burma during 1934–35, 6 moths emerged in March and April, having completed the cycle from egg to adult in one year [*cf. R.A.E.*, A **23** 210]. Larvae were introduced into *Callicarpa arborea*, known to be an alternative food-plant, but decreased in number after some months activity. Female moths captured in the field and caged died one or two days after mating and laying fertile eggs. The moths emerged in late March, mid-April and early May in the south, centre and north of Burma respectively, probably depending on the climate. In the northern district the new growth on the trees is already vigorous when the young larvae appear. On the observation plots, out of an initial number of 400 bee-holes in 1933, only 9 moths emerged, 5 in 1934 and 4 in 1935. Woodpeckers probably accounted for most of the reduction. Infestation in 1935 was again small, owing to the scarcity of the moths during the 1934 season. Pupae of the Ichneumonid parasite of *X. ceramicus* [*cf.* **21** 183] were found in August, and an adult emerged from one of them towards the end of the month. Emergence in August implies that the parasite must utilise an alternative host during the nine months that elapse before young larvae of *Xyleutes* are available. It is always the young larvae that are attacked and these only occur for a relatively short period at the beginning of the monsoon.

The population of *Hapalia machaeralis*, Wlk., was reduced by 90 per cent. when the leaves of teak began to fall [*cf.* **23** 210]. It has been found that when this Pyralid is reared for a few generations in the insectary most of the moths emerging are females ; this is not due to crowding and is not affected by starvation. The viability of both eggs and larvae agreed with field observations. The insects were reared from egg to adult on *Callicarpa arborea* and *C. macrophylla* ; larvae fed on *Tectona hamiltonia* but refused *Plumeria acutifolia*. They were not found on any of these plants in the field. Investigations on *Trichogramma* sp. parasitic on the eggs of *H. machaeralis* [*cf.* **22** 123] showed that it also accepted eggs of *Ephestia* and *Sitotroga cerealella*, Ol.

The other teak defoliator, *Hyblaea puera*, Cram., was not taken from mid-December to March [*cf.* **23** 210]. It was found on a new food-plant, *Vitex* sp., and 3 new pupal parasites emerged in cages.

Immersion of bamboo dunnage in fresh or salt water for 4–6 weeks gave considerable immunity from *Dinoderus* spp., of which *D. brevis*, Horn, and *D. minutus*, F., were commoner than *D. ocellaris*, Steph. Treatment in salt water for more than 6 weeks caused deterioration through attack by *Teredo*.

Infestation of *Gmelina arborea* by *Calopepla leayana*, Latr., was severe and may be correlated with the climate. In May and August, when the young larvae of the first and second generations respectively are prevalent, heavy rains favour light infestations, and sunny periods favour heavy ones. The beetles invade plantations from surrounding jungle, and infestation progresses from the outside of the plantation inwards, with the result that outside trees have no chance to recover from successive attacks. The shoots and buds are destroyed when no leaves are available. In April and May 183,000 resting adults were collected and destroyed, and in August 147,000 adults were taken on white sheets. It was found that flying adults are attracted by white objects.

At the end of the year, when hibernation grounds were cleared, many beetles escaped the fire by hiding in old insect holes, woodpecker holes and crevices. Traps simulating known hibernation quarters are also recommended, and the poisoning of the foliage in a strip along the edge of the plantations to kill the adults when they emerge might have good results. Although the pupal parasite, *Brachymeria* [**23** 211], accepted pupae of *Aspidomorpha miliaris*, F., the action of oviposition apparently killed the latter. *Brachymeria* is a somewhat polyphagous feeder, however, and will accept other hosts than *Calopepla*. Attempts to rear the egg parasite of *Calopepla* [*loc. cit.*] on the eggs of *Aspidomorpha* were unsuccessful.

A female of *Xyleutes persona*, Le Guillou [*cf. loc. cit.*] reared on *Cassia fistula* emerged on 15th March 1935 after completing a life-cycle of $2\frac{1}{2}$ years. Another moth from the same brood of eggs emerged 4 months earlier. They laid about 12,000 and 15,000 eggs respectively. The larvae of this species are even more likely than those of *X. ceramicus* to forsake their old galleries and construct new ones as they increase in size.

Subramaniam (T. V.) & Ramiah (C. V.). **Sugarcane Borer Control in the Mysore State.**—*Circ. Mysore Dep. Agric.* no. 55, 6 pp., 2 pls. Bangalore, 1935; also in *J. Mysore agric. exp. Un.* **15** no. 4 pp. 130–136, 1 pl. Bangalore [1935].

Most of the larvae of *Argyria sticticraspis*, Hmps., and *Diatraea venosata*, Wlk., that hatch from eggs laid in sugar-cane leaves [*cf. R.A.E.*, A **23** 87] crawl between the first leaf-sheath and stem of the plant. They tunnel for a few days in the tissue of the leaf-sheath and then bore into the stem, causing dead-heart, and finally attack the tillers. The greatest damage occurs when the plants are 4–5 weeks old and the top of the leaf-sheath is a little detached from the stem. Removing the leaf-sheaths from young cane plants in the field and dropping them into a vessel containing water and kerosene markedly reduced the larval population and the numbers of dead-hearts. A second method of control is to earth up the plants lightly on both sides so as to cover up the first leaf-sheath. By irrigating soon afterwards, the soil is settled around the shoots, the older larvae are prevented from getting out, and the young ones are killed. In experiments to test the efficiency of these methods singly and combined the percentage of dead-hearts was 24·3, 14·6 and 10·7, respectively. From 100 plants selected at random, 120 larvae were obtained of which 85 per cent. were dead. Many of the older larvae were capable of getting out of the stem and damaging adjacent tillers by boring through the soil, particularly in stony soil. Earthing up appeared to stimulate the growth of the canes. The larvae that hatch after it has been done are unable to get into the stem through the leaf-sheath; and although they may attack the upper part of the shoots, very little damage is noticed on account of the vigorous and rapid growth of the seedlings. If dead-hearts are noticed on the tillers 4 or 5 weeks after the first earthing up, a second one may be necessary. When the crop is 8 or 9 weeks old, any dead-hearts present should be cut out close to the level of the ridge formed by the first earthing up and another carried out. This buries the stumps and prevents the emergence of any moths from them.

GLOVER (P. M.). **Department of Entomology.**—*Rep. Indian Lac Res. Inst. 1934–35* pp. 13–25. Namkum, Ranchi, 1935.

During the year under review, lime-sulphur sprays failed to control *Aspidiotus orientalis*, Newst., which is apparently becoming immune from them. In preliminary tests, a completely refined low boiling petroleum distillate [*cf. R.A.E.*, A **23** 178, 328] killed all the scales and only caused slight injury to the trees, which rapidly recovered. Other pests of host-trees of *Laccifer lacca*, Kerr, besides those already noticed [**23** 248 ; **24** 137] were *Sternocera orientalis*, Hbst., *S. orientalis* var. *basalis*, Lap. & Gory, and *S. diardi*, Gory ; *Tessaratoma javanica*, Thub., on *Schleichera trijuga* and litchee (*Nephelium litchi*) ; and *Icerya aegyptiaca*, Doug., which occurred for the first time at Namkum on custard apple (*Anona squamosa*), guava (*Psidium guayava*), rose, *S. trijuga*, *Aleurites fordii* and fallen leaves of *Ficus bengalensis* and was controlled by kerosene soap emulsion.

The eleventh generation of a parthenogenetic strain of *L. lacca* that is being reared in the laboratory [*cf.* **23** 248, etc.] is developing satisfactorily. The information given on many of its natural enemies is similar to that already noticed [**23** 86, 746]. In experiments to determine whether larvae of *Eublemma amabilis*, Moore, the most important predator of the lac insect, could be kept in a healthy condition at reduced temperatures until required as hosts for *Microbracon greeni*, Ashm., and *M. hebetor*, Say [*cf.* **23** 248], from 3–7 per cent. of 5,650 tenth instar larvae kept at 12–27°C. [53·6–80·6°F.] were alive after 3 weeks, whereas the control larvae had nearly all died or pupated after a week. *M. greeni* and *M. hebetor* oviposited on the larvae and the eggs hatched, but the host larvae dried up. *M. greeni* parasitised an average of 10·8 per cent. of the larvae of *E. amabilis* as compared with 7·1 in the previous year [**23** 249]. Unsuccessful attempts were made to induce *Pristomerus testaceicollis*, Cam., which is an endoparasite of the larva of *Holcocera pulverea*, Meyr. [*cf.* **23** 146], to oviposit in the laboratory. Adult females that emerged in November lived an average of 57 days.

GLOVER (P. M.). **Further Notes on the Chalcidoid Parasites of *Laccifer lacca*, Kerr.**—*Bull. Indian Lac. Res. Inst.* no. 22, 4 pp., 4 refs. Nankum, Ranchi, 1935. Price *Rp.* 1.

Further work in 1934–35 on the Chalcidoid parasites of *Laccifer lacca*, Kerr, in India [*cf. R.A.E.*, A **23** 86] confirmed the author's conclusions that they do little damage to the lac crop and that hyperparasites are of little value in controlling them. Between 1928 and 1935 the average percentage parasitism varied from a minimum of 2·6 in 1930–31 to a maximum of 7·2 in 1932–33 and between 1930 and 1935 the average percentage hyperparasitism varied from a minimum of 0·4 in 1930–31 to a maximum of 8·6 in 1931–32.

KALSHOVEN (L. G. E.). **Dermestiden in Nederlandsch-Indië. 1. Aanteekeningen over hier voorkomende tapijtkevertjes (*Anthrenus* en *Attagenus* spp.).** [Dermestids in the Netherlands Indies. 1. Notes on Carpet Beetles occurring there.]—*Ent. Meded. Ned.-Ind.* **1** no. 4 pp. 72–76, 3 figs. Buitenzorg, 1st December 1935. (With a Summary in English.)

Larvae of *Anthrenus pimpinellae*, F., have been found in Java infesting horse hair, the plush upholstery of a motor car and tape in

portfolios. *Aethriostoma* (*Attagenus*) *gloriosae*, F., has been observed with *A. pimpinellae* in horse hair, and also in storehouses and in an oil mill.

WATANABE (C.). **On some Species of Braconidae from North China and Korea.**—*Insecta matsum.* **10** no. 1–2 pp. 43–51, 1 fig. Sapporo, November 1935.

The Braconids recorded are: *Microbracon* (*Bracon*) *nigrorufum*, Cshm., reared from *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in Korea and North China; *M.* (*B.*) *isomera*, Cshm., *M.* (*Habrobracon*) *pectinophorae*, sp. n., and *Chelonus pectinophorae*, Cshm., from *P. gossypiella*, and *Rhogas dimidiatus*, Spin., from *Euxoa segetum*, Schiff., in Korea; *Rhogas spectabilis*, Mats., from *Dendrolimus spectabilis*, Butl., *Petalodes unicolor*, Wesm., from *Pygaera* (*Melalopha*) *anachoreta*, F., *Chelonus tabonus*, Sonan, and *Apanteles derogatae*, sp. n., from *Sylepta derogata*, F., *A. ruficrus*, Hal., from *Cirphis unipuncta*, Haw., *A. taoi*, sp. n., from *Illiberis pruni*, Dyar, and *A. parnarae*, sp. n., from *Parnara guttata*, Brem., all in North China; and *A. eguchii*, sp. n., from *Earias chromataria*, Wlk., in Korea and North China.

The females of all the new species are described, and the males of *M. pectinophorae* and *A. parnarae*.

KÔNO (H.) & WATANABE (C.). **A New Braconid-parasite of the Bark-boring Beetle, *Cryphalus piceus* Eggers.**—*Insecta matsum* **10** no. 1–2 pp. 67–70, 1 fig. Sapporo, November 1935.

Descriptions are given of both sexes of the Braconid, *Ecphylus hattorii*, sp. n., reared from *Cryphalus piceus*, Eggers, which causes considerable injury to *Abies sachalinensis*, in Hokkaido.

SUMMERVILLE (W. A. T.). **White Wax Scale.**—*Qd agric. J.* **44** pt. 5 pp. 556–559, 1 pl. Brisbane, 1st November 1935.

Of recent years, *Ceroplastes destructor*, Newst., has been increasing considerably on *Citrus* and other plants in Queensland, where it is more common in humid coastal parts. The young are found mainly on leaves and twigs, and the older scales just below the twigs on growth that has hardened during their attachment. There is apparently only one complete generation a year. The young emerge mainly from November to February, though sometimes as late as May. Sprays are directed against the youngest possible individuals. In light infestations the infested parts can be removed and burned. When this is impracticable, a wash of $1\frac{1}{2}$ lb. sodium carbonate in 4 gals. water is recommended. A spray similar to that used against the bronze orange bug [*Rhoecocoris sulciventris*, Stål] [*R.A.E.*, A **19** 714] is very effective if used at the correct time.

JARVIS (H.). **Spraying Experiments for the Control of Fruit Fly in the Stanthorpe Districts.**—*Qd agric. J.* **44** pt. 5 pp. 560–563. Brisbane, 1st November 1935.

These experiments on the use of sprays applied at weekly intervals for protecting apples and plums from infestation by the fruit-fly [*Dacus ferrugineus*, F.] in Queensland in 1934–35 [*R.A.E.*, A **24** 196] were rather inconclusive owing to the absence of infestation in some of the orchards and to a severe hailstorm, which destroyed much of the fruit.

The sprays consisted of ½ pint nicotine sulphate, ½ gal. white oil and 40 gals. water ; ½ gal. white oil and 40 gals. water ; and 1 oz. colloidal sulphur in 4 gals. water. In one experiment when one variety of apples was sprayed 4 times, these sprays gave 77·6, 59·6, and 70·6 per cent. sound fruit, respectively, as compared with 44·6 on the control. The percentages on 2 plum trees that received 3 applications, beginning on 18th January, of the nicotine sulphate and white oil spray were 87 and 94·2, as compared with 57·5 and 51·7 on the controls. The fruit was picked on 14th February, and although its appearance was spoilt to some extent by greasy and dull patches, it was quite saleable. The white oil caused some scalding where apples were exposed to the sun and the colloidal sulphur caused the formation of minute discoloured spots. Neither of these blemishes, however, affected the market value of the fruit.

Veitch (R.). **Potato Tuber Moth and its Control.**—*Qd agric. J.* **44** pt. 6 pp. 694–696, 9 figs. Brisbane, 1st December 1935.

A brief popular account is given of the bionomics and control of *Phthorimaea operculella*, Zell., on potatoes in Queensland.

Cunningham (G. H.). **Plant Protection by the Aid of Therapeutants.**—Demy 8vo, xxvi+243 pp., 4 pls., 23 figs., 26 pp. refs. Dunedin, 1935. [Obtainable from the author at the Plant Research Station, Palmerston North, N.Z. ; price not stated.]

Information in regard to materials and apparatus used in the control of bacteria, fungi and insects attacking plants and plant products is assembled under six sections, based on processes of application. The first deals with sprays and spraying, under the various groups of chemicals used, together with spreaders, adhesives, suspensors and activators, and includes a chapter on apparatus and methods of application ; the second with dusts and dusting ; the third with fumigants and fumigation ; the fourth with disinfection of seeds, tubers, bulbs and corms ; the fifth with soil disinfection ; and the sixth with miscellaneous subjects such as fruit washing, tree surgery, and conversion of weights, measures and temperatures. A glossary of mathematical, chemical, botanical and zoological terms and an index are added.

de Gryse (J. J.). **On the Use of Parasites in the Control of Forest Insects.**—*For. Chron.* **11** no. 3 pp. 8–11. Knowlton, Que., September 1935.

In discussing the use of parasites in the control of forest insects in Canada, the author records three examples of successful biological control. *Lygaeonematus erichsoni*, Htg., destroyed nearly all the considerable larch stands east of the Great Lakes between 1880 and 1890, subsequently spread westward through the prairie provinces, and has recently been reported in British Columbia [see next paper]. Between 1909 and 1913 the parasite, *Mesoleius tenthredinis*, Morl., was imported from England and liberated in several localities in New Brunswick, Quebec, Ontario and Manitoba without observable result. Several years later, however, when *L. erichsoni* began to appear in greater numbers than usual in Manitoba, *M. tenthredinis* was found to be abundant as far as 200 miles from the point of original liberation, and reduced the sawfly population before any serious damage was done. This process is being repeated in certain areas of Quebec, where

systematic collection of sawfly cocoons has supplied ample justification for attributing the control of *L. erichsoni* principally, if not exclusively, to the action of the parasite.

In 1910, *Compsilura concinnata*, Mg., was introduced to control the browntail moth [*Nygmia phaeorrhoea*, Don.], in New Brunswick and Nova Scotia. Owing to an eradication campaign, this moth soon ceased to be a menace, but the parasite became established on a number of native species, and much later effectively retarded the development in eastern Canada of the satin moth [*Stilpnotia salicis*, L.], another European insect that subsequently became a pest of poplar and willow in the Maritime Provinces. In British Columbia, this moth is controlled by another imported parasite, *Apanteles solitarius*, Ratz.

Lecanium coryli, L., which some years ago became very destructive on shade trees in and around Vancouver, was practically exterminated within 4 years of the introduction of *Blastothrix sericea*, Dalm., from England in 1928 and 1929.

HOPPING (G. R.). **A Forest Insect Problem in British Columbia.**—*For. Chron.* **11** no. 4 pp. 258–261. Knowlton, Que., December 1935.

Lygaeonematus erichsoni, Htg., almost wiped out the larch stands of the eastern provinces during the 3 years following its discovery in Canada in 1882 and then became very scarce until 1905, when it again became noticeable on ornamental European larches and some native larch swamps. By 1910 it had spread westward to Saskatchewan and was discovered in September 1933 in British Columbia. Possible methods of spread are discussed. The eggs are laid in late spring and early summer in slits cut in the new shoots of the larch and hatch in 10 days. The larvae feed on the needles until late summer when they drop from the trees and spin cocoons in the soil under débris, stones, etc. They pupate in early spring, and the adults emerge when the new larch shoots are well developed. As investigation showed that the sawfly had been present in British Columbia for at least 3 years and was spreading considerably, immediate steps were taken to obtain parasites for liberation. A high degree of parasitism by *Mesoleius tenthredinis*, Morl., was discovered in 1934 in an infested area in Quebec [*cf.* preceding paper]. Adults bred in this area were taken to British Columbia and liberated there. From 6,287 cocoons of the sawfly collected in 1935 near the points of liberation, 1,179 contained the parasite, indicating that it is permanently established and that a higher degree of parasitism may be expected in 1936. This parasite had not been obtained from large collections of cocoons prior to the liberations. One native parasite, the Pteromalid, *Coelopisthia nematicida*, Pack., was found to be aiding in the reduction of the sawfly, and a fungus *Isaria* sp. destroys the larvae in the cocoons, which are also attacked by mice and voles. Birds attack the larvae feeding on the larch in spring and summer.

STIRRETT (G. M.). **A Contribution to the Knowledge of Sugar-beet Insects in Ontario. A historical Review and preliminary Survey of the Insects associated with Sugar-beets.**—*Sci. Agric.* **16** no. 4 pp. 180–196, 36 refs. Ottawa, December 1935.

Records of insects attacking beet and mangels in Ontario are briefly reviewed from the literature, and short notes are given on those that have been observed on sugar-beet other than in the regular collections

during the past few years. The numbers of various species of insects that were taken in weekly collections in a field of sugar-beet in 1933 and 1934 and the total number taken from various fields in those years are tabulated under their orders. Certain predators and parasites of beet pests that were also caught are enumerated. An annotated catalogue of the invertebrates associated with the beet plant in Ontario is appended.

Essig (E. O.). **California Aphididae. New cloudy-veined Species.**—*Pan-Pac. Ent.* **11** no. 4 pp. 156–162, 3 figs., 9 refs. San Francisco, Calif., 10th January 1936.

The author discusses the generic position of *Rhopalosiphum violae*, Perg. This Aphid has been referred to *Fullawayella* and *Neotoxoptera*, but the former genus is synonymous with *Idiopterus*, the types *F. kirkaldyi*, Fullaway, and *I. nephrolepidis*, Davis, being identical, and he considers that the latter, though erected for an aberrant form that has proved to be *violae*, must be discarded as it does not adequately characterise the species. He therefore places *violae* in *Micromyzus*, of which the type is *M. nigrum*, v.d.G., and to which also belong the new species of which the alate and apterous viviparous females are here described from California. These are *M. alliumcepa*, first collected in 1927 on dry onion sets, and *M. oliveri*, which was discovered on the lower surfaces of the lower and older leaves of the common English marigold (*Calendula officinalis*) in March 1935. Only apterous forms of *M. alliumcepa* were present when it was first observed, and these completely disappeared without reproducing. It was again observed in March and April 1935 on leeks, onions and chives in two separate localities in California. Inquiries have failed to elicit further information as to its distribution and its origin is unknown.

Flanders (S. E.). **Host Influence on the Prolificacy and Size of *Trichogramma*.—*Pan-Pac. Ent.* 11** no. 4 pp. 175–177, 2 refs. San Francisco, Calif., 10th January 1936.

It has been found by various workers engaged on mass production in the United States of two species of *Trichogramma* [*minutum*, Riley, and *pretiosum*, Riley] for which the author considers the correct names to be *evanescens*, Westw., and *embryophagus*, Htg., respectively [*R.A.E.*, A **23** 442], that *T. minutum* is more prolific than *T. pretiosum*, when *Sitotroga cerealella*, Ol., is the host. When reared on eggs of the bag-worm [*Thyridopteryx ephemeraeformis*, Haw.], however, Peterson found *T. pretiosum* more prolific than *T. minutum* [**20** 34], attributing its greater fertility to its longer life. Schread & Garman, who found *T. minutum* to be more prolific than *T. pretiosum* [**22** 314], think that this is due to the higher ratio of females produced by the former.

In recent investigations of the development and mortality of both species when reared on eggs of *Estigmene acraea*, Drury, the size of which permits the development of 1–10 individuals per host egg, the average number of adult parasites produced per egg after each egg had been exposed to a single female was 4·3 for *T. minutum* and 5·4 for *T. pretiosum*, the sex ratio being 2 females to 1 male in each case.

An explanation of the conflicting observations of the authors noted may be found in a possible tendency on the part of *T. pretiosum* to deposit more eggs per host than *T. minutum* if other conditions are

equal. In this case *T. pretiosum* would be the less prolific of the two species on small hosts such as *S. cerealella*, but the more prolific on large ones.

In the eggs of *E. acraea* one female of *T. minutum* may deposit 3 eggs without withdrawing the ovipositor, the progeny of a mated female from one egg consisting normally of 2 females and 1 male. If the female is allowed time to deposit only one egg, the solitary offspring is invariably female. Solitary parasites in eggs of *E. acraea* develop more slowly than gregarious ones, apparently because the larva must consume a large amount of food to render the interior of the host suitable for pupation. The abdomen of *T. minutum*, unlike that of *T. pretiosum*, when solitary becomes so large that it has difficulty in emerging from the host. As the eggs of *E. acraea* are uniform in size, the total mass of parasites developing in one egg is about equal to the total mass developing in another, regardless of the number of parasites present. Large females of *Trichogramma* may be over five times as prolific as small ones. One female of *T. minutum* parasitised as many as 200 eggs of *S. cerealella*. Large females of *Trichogramma* are also able to oviposit in larger hosts than are small ones. Thus the thick-shelled eggs of *Pachysphinx modesta*, Harr., which are readily parasitised by large females, are immune from small ones. On the other hand large females tend to ignore hosts of less volume than their own bodies. Solitary parasites from eggs of *E. acraea* refused to oviposit in eggs of *S. cerealella*, although their parents had been bred from this host. The largest number of adults obtained from one egg of *P. modesta* was 50. As many as 75 were dissected from a single egg, but the smaller ones are unable to cut their way through the thick shell. When the largest possible number of parasites develops in a single host they are of minimum size.

Davis (J. J.). **Profits and Losses in Greenhouse Management.**—*Proc. Amer. Carnation Soc.* **41** pp. 40–52, 10 refs. Nashville, Tenn., 1935.

Problems relating to the control of insect pests in greenhouses and the effects of greenhouse practices on them are outlined, and brief general notes are given on the main types of insects and other pests of importance to carnation growers in the United States. Dusts, sprays and fumigants used in the greenhouse are discussed, and reference is made to instruments for the determination of humidity. A list of publications dealing with insect problems in the greenhouse is added.

McKenzie (H. L.). **Life History and Control of the Gladiolus Thrips in California.**—*Circ. Calif. agric. Exp. Sta.* no. 337, 16 pp., 5 figs., 3 refs. Berkeley, Calif., June 1935. [Recd. February 1936.]

Since its first appearance in California in 1932, *Taeniothrips simplex*, Morison (*gladioli*, Mlt. & Stnw.) has caused considerable damage to *Gladiolus* in 4 counties. A list is given of various food-plants on which it has been taken [*cf. R.A.E.*, A **21** 464, etc.], all stages are briefly described, and the injury caused is discussed [*cf.* **20** 420; **21** 287; **23** 4]. The larvae appear to cause more damage than the adults, especially to the flower spikes. Experiments on the life-history

and control of the thrips were begun in California in 1934. The eggs are deposited in the tissue of the leaf or corm. The average durations of the egg, first and second instar larval, prepupal and pupal stages were 5·5, 2·5, 3, 2·5 and 3 days, respectively, in June at a maximum temperature of 68–80°F. Data on the life-history obtained at temperatures of 60–80°F. by C. A. Weigel, who also stated that one female laid 100–200 eggs, are tabulated for comparison. The adults usually live about a month with a maximum of 2½. Reproduction is bisexual, and males are found throughout the year. Only males are produced by parthenogenesis. The thrips, particularly the adults, come out on to the exposed leaf surfaces at about 8–9 a.m. and 4–5 p.m. and on cloudy days. This may be due to lack of available food in the leaf-sheaths. The insects are apparently most abundant at flowering time. They overwinter between crops on self-sown gladiolus plants. A few adults were caught in tanglefoot bands placed 20 ft. from infested plants and 15 ft. high. Wind probably aids in their dispersal. The predator, *Orius* (*Triphleps*) *tristicolor*, White, was occasionally observed feeding on the thrips. S. F. Bailey states that *Thripoctenus russelli*, Crwfd., was taken parasitising the thrips at Sacramento.

Among the treatments recommended for stored corms [**21** 256, 479, 512] are immersion for 20–30 minutes in hot water at 112–114°F.; immersion for 17 hours in mercury bichloride solution (1 oz. to 7 U.S. gals. water); and 2 fumigations for 4 hours with calcium cyanide at the rate of 2 oz. per 100 cu. ft., the second being given after 10 days. In experiments one fumigation for 4 hours using 50 oz. per 100 cu. ft. killed all the stages including the eggs and did not injure the corms. Of various contact and stomach poisons applied to the plants in the field, the most satisfactory was 4 lb. manganese arsenate, 66 lb. brown sugar and 100 U.S. gals. water. Of the other sprays cryolite and potassium fluoaluminate cannot be used safely along the coast, owing probably to the high humidity; and Paris green with zinc sulphate or hydrated lime appeared to be fairly satisfactory except during the winter when it caused a considerable amount of injury. Weekly applications of the manganese spray should be given in the summer, beginning when the plants are about 2 ins. high and continuing until the flower spikes appear. During the winter fortnightly applications should be given. In extremely humid weather the concentration of the manganese arsenate should be reduced, but in the winter of 1934–35 no apparent injury was caused by this spray. A mixture of 2 lb. Paris green and 66 lb. brown sugar in 100 U.S. gals. water can be used in dry regions, but for use on the coast hydrated lime or zinc sulphate should be added to avoid scorching the foliage. In heavily-infested areas the flower spikes should be cut down and burned, one or two sprays given and the plants watered heavily.

McKenzie (H. L.). **Biology and Control of Avocado Insects and Mites.** —*Bull. Calif. agric. Exp. Sta.* no. 592, 48 pp., 27 figs., 5 pp. refs. Berkeley, Calif., July 1935. [Recd. January 1936.]

The recent development in the cultivation of avocado in California has been accompanied by increased injury from pests, including both native and recently introduced species. In addition to a list of these species and notes on the bionomics and control of the more important ones, a complete list is given of insects and mites attacking avocado

throughout the world, so that precautions can be taken to guard against their introduction.

A key is given to the Diaspine scales occurring on avocado in California. *Aspidiotus lataniae*, Sign., which is probably the chief pest of the crop there, is at first most abundant on the branches and twigs and later attacks the leaves and fruit. In heavy infestations the smaller branches are killed and the marketing quality of the fruit is impaired. The history, synonymy, distribution and food-plants of this Coccid are discussed. Apart from avocado, which seems to be the primary food-plant, it has been found in California only on *Canna*, *Gladiolus*, *Grevillea thelemanniana*, raspberries, rose and *Tamarix* sp. The eggs hatch in a few hours ; the larva, which is briefly described, settles within 8 hours and starts to secrete wax. The life-cycle from egg to adult lasts 56–65 days in summer. Birds, insects and man are partly responsible for dispersion of this scale, and individual larvae or an infested leaf may be carried some distance by wind. *Aphytis diaspidis*, How., the eggs and larvae of which are briefly described, is the only parasite known to attack it in California. Coccinellids predacious on it are *Chilocorus stigma*, Say (*bivulnerus*, Muls.), *Lindorus lophanthae*, Blais., and *Cycloneda rubripennis*, Csy., which are briefly described.

Tests made in 1932–33 with several different oil sprays gave little promise of control, and caused defoliation as well as possible inhibition of set of fruit, but a highly refined medium grade of oil may be applied at 2 per cent. strength with reasonable safety and secure a fair degree of kill. Good control was obtained by fumigation with hydrocyanic acid gas ; details of the method are given, with a dosage chart. Calcium cyanide is recommended for small plantings and liquid HCN for large ones. The danger of breaking branches and the size of the trees render fumigation of avocados more difficult than that of *Citrus*. A light-weight tent hoisted with bamboo poles or a special derrick has been designed to meet these difficulties. Fumigation is most effective between July and October. It should not be carried out when the wind blows sufficiently to move the tents, when the foliage or ground are wet, or in warm, bright sunlight. Permanent injury may be caused to blossoms and young fruit, but tender growth, when scorched, is rapidly replaced and the tree recovers.

Other Diaspine scales attacking avocado are *Chrysomphalus dictyospermi*, Morg., *A. hederae*, Vall., *Aonidiella aurantii*, Mask., and *Aspidiotus rapax*, Comst. (*camelliae*, Sign.), which, although it has hitherto caused little damage, is likely to become an important pest, as in Florida.

Coccus hesperidum, L., which is common along the coast, produces much honeydew causing smutting, and has several generations a year ; it is attacked by many parasites but protected by ants. *Saissetia oleae*, Bern., is only of importance in rare cases.

Sabulodes caberata, Gn., the most important leaf-feeding insect attacking avocado, sometimes entirely defoliates the trees. Its history, synonymy, distribution and numerous food-plants are discussed, and all stages are described. It appears to have 5 or 6 generations a year. The eggs are laid in clusters of 3–80 on the lower surfaces of the leaves and hatch in 8–9 days. When it reaches the third or fourth instar, the larva spins a web in a leaf fold, or between two or more leaves, where it rests during the day. The larval period (including five instars) lasts 25–65 days and the pupal 13–33 days. Female moths caught

in the field laid 200–300 eggs. The adults live for 2–3 weeks. The most important parasite is *Microbracon* (*Habrobracon*) *xanthonotus*, Ashm., the egg, larval and pupal stages of which last 1–2, 4–6 and 8–10 days, respectively. The cocoons are found in clusters of 18–22. This Braconid parasitised 70 per cent. of the larvae in 1932, but this was not sufficient for control. Other parasites are *Trichogramma minutum*, Riley, *Brachymeria ovata*, Say, *Telenomus* sp., and *Ophion abnormis* var. *magniceps*, Hooker. During the latter part of 1932 and 1933, the larvae were controlled by a fungus disease which seems to attack only the third and subsequent instars. Very few moths were caught in tests with light and bait traps. Of insecticides tested, the best was standard lead arsenate applied as a spray (4 lb. to 100 U.S. gals. water with 6 lbs. blood albumin spreader) or as a dust mixed with 70 per cent. diatomaceous earth, or sulphur if mites are present.

The Tortricid, *Amorbia essigana*, Busck [*cf. R.A.E.*, A **17** 518], has caused considerable injury to avocado, scarring the young fruits and skeletonising the leaves, which it webs together. The eggs are laid on the leaves in masses of 5–98. A single moth may lay 400–500 eggs. The egg, larval and pupal stages last 13–15, 31–112 and 11–21 days. The pupae are usually found between leaves webbed together. There appear to be 4–5 generations a year. *T. minutum* attacked the eggs but was not effective in control. Light traps and bait traps were ineffective. Lead arsenate sprays and dusts should be used as for *S. caberata*, but owing to overlapping generations, several applications at monthly intervals are required.

Occasional outbreaks of the Melolonthids, *Serica fimbriata*, Lec., and *S. alternata*, Lec., have been observed on young avocado trees. The adults are nocturnal and the larvae feed underground on decayed and living vegetation, usually near an avocado grove. The lead arsenate spray gave only fair results in controlling these beetles, and if the trees are in bloom, the dust is recommended. One very serious infestation of *Asynonychus* (*Pantomorus*) *godmani*, Crotch, which is described, was observed in 1933. The weevils, which cannot fly, may be prevented from ascending the trees by the use of tanglefoot bands. Cryolite dust apparently kills them more effectively than lead arsenate, but the injury to the trees renders its use unsafe along the coast.

Paratetranychus yothersi, McG., sometimes causes damage to the leaves of avocado, but control measures are only necessary where climatic conditions favour great abundance of the mite. Its distribution and other food-plants are discussed. Feeding is confined to the upper surface of the leaf, which becomes entirely brown if mites are numerous, though restoration is rapid if they are destroyed before injury is too severe. Injured leaves, however, fall prematurely. Females lay on an average about 35 eggs. They hatch in 7–10 days, and the larval and two nymphal stages last 2–3 days each. The mites are capable of travelling long distances, but generally remain on the same leaf throughout their life. Wind is the greatest factor in dispersion, mites or infested leaves being frequently blown to the ground, but birds and insects carry small numbers. One or two applications of sulphur dust, made when there is little wind, effect satisfactory control.

Brief notes are also given on *Heliothrips haemorrhoidalis*, Bch., and *Nysius ericae*, Schill., which sometimes attack avocado, and on *Caulophilus latinasus*, Say, which has only been found in the fallen fruits.

Cressman (A. W.) & Plank (H. K.). **The Camphor Scale.**—*Circ. U.S. Dep. Agric.* no. 365, 19 pp., 7 figs., 17 refs. Washington, D.C., October 1935.

Pseudaonidia duplex, Ckll., which was probably introduced from Japan, was first discovered in injurious numbers in the United States in 1920 [*cf. R.A.E.*, A **10** 73] and is now generally distributed in south-central Louisiana. Isolated infestations are present elsewhere in that State and in Mississippi, Alabama and Texas. The Coccid has survived temperatures of 10°F. in northern Louisiana, and it would probably thrive under greenhouse conditions anywhere in the United States. It has undoubtedly been spread through the sale of infested plants ; a list is given of nearly 200 plants on which it has been found in Louisiana. Camphor trees (*Cinnamomum camphora*), Satsuma orange (*Citrus nobilis unshiu*), fig (*Ficus carica*), persimmon (*Diospyros kaki*) and various ornamental plants and shade trees are severely infested. The scales and immature stages are briefly described. The newly hatched nymphs wander about on the plant for some 24 hours before settling. The female moults twice and the male four times. Observations in the insectary and field showed that the first instar, second instar, preoviposition period, and period from deposition of the first egg to hatching of the nymphs averaged 10–11, 15–17, 17–20, and 9–11 days, respectively. Most of the scales overwinter in the adult stage, but there is no well-defined hibernation period. The number of eggs beneath the coverings begins to increase in January, and the crawlers start to emerge in February or March. In the New Orleans district there are usually three complete generations a year, but a fourth may develop when the temperature is higher than usual. As the rate of development is largely dependent on the temperature, it is possible to predict accurately the time of the appearance of each stage from a consideration of the average temperature [**23** 415].

Hymenopterous parasites observed in southern Louisiana were *Aphytis* (*Aphelinus*) *fuscipennis*, How., *Aspidiotiphagus citrinus*, Cwfd., *Prospaltella aurantii*, How., *P. fasciata*, Malen., *Aphytis* (*Aphelinus*) *diaspidis*, How., and *Signiphora flavopalliata*, Ashm., but none gave appreciable control. *Alaptus* (*Metalaptus*) *torquatus*, Malen., was taken from cages containing the scales but it may be a parasite of Psocid eggs. In limited areas the predators, *Platoeceticus gloveri*, Pack. [*cf.* **23** 19], *Chilocorus bivulnerus*, Muls., and *Pentilia* (*Microweisea*) *misella*, Lec., have occasionally considerably reduced the infestation. The fungi, *Microcera coccophila* and *Cladosporium* sp., are parasitic on the scales but have not given permanently effective results.

The best method of control is by spraying with petroleum oil emulsions, and methods of preparing three types are given. The first consists of 2 U.S. gals. oil, 1 U.S. gal. water and 2 lb. potash fish-oil soap or 1 lb. hard soap. The mixture is heated and then pumped, and should be diluted 1 : 19 to give a 3 per cent. dormant spray and 1 : 50 to give a 1·2 per cent. spray for spring and summer applications. With a power sprayer developing 300–400 lb. pressure, an emulsion containing 10 U.S. gals. oil, 5 U.S. gals. water and 3 lb. fish-oil soap is more easily prepared. The ingredients should be mixed in the spray tank and pumped for 10 minutes. The proportion of soap is the minimum that can be used without danger to the plant. The

resulting emulsion deposits more oil than the preceding one and should be diluted 23 times to give a 2·5 per cent. spray for dormant applications and 60 times to give a 1 per cent. spray for spring and summer use. Emulsions that are not affected by hard waters may be prepared with 8 U.S. gals. lubricating oil, 4 U.S. gals. water and 1 lb. calcium caseinate, but these do not keep well. They should be diluted in the same proportions as the first emulsion. Highly refined oils are less toxic to the plants than less refined ones and are just as toxic to the scales but are more expensive. The efficiency of the spray increases with the viscosity of the oil, and an oil having a viscosity within the range of 100–200 secs. Saybolt is recommended. The best time to spray camphor and other plants (except *Citrus*, which may be injured if a frost follows the application of an oil spray) is during the dormant season. Practically all the exposed scales in the first two instars and those of the third that are not more than 1 week past the second moult can be killed with sprays containing 1 per cent. oil in spring and summer. In New Orleans, these sprays are best applied about 57 and 36 days, respectively, after the appearance of the first nymphs of the first and second generations. At these times not more than 3–5 per cent. of the scales are reproducing and nearly all the others are in stages capable of being killed. The oil remaining after spraying is sufficient to destroy most of the nymphs emerging during the next 2 weeks. When the infestation has been reduced with summer sprays it can be kept in check with one dormant spray each winter. The branches and twigs of camphor trees, where most of the scales are present, should be well sprayed and the leaves avoided. All parts of *Citrus* trees should be well sprayed as scales are found on the leaves, fruit and stems.

The Coccid is best controlled on nursery stock or other plants that are to be shipped by fumigating with hydrocyanic acid gas in a gas-tight container. The foliage and twigs should be thoroughly dry, and the plants should not be exposed to direct sunlight for several hours before and after treatment. The dosage schedule per 1,000 cu. ft. for an hour's exposure is $\frac{3}{4}$ oz. sodium cyanide, 1 fl. oz. sulphuric acid (at least 65°Bé) and $2\frac{1}{4}$ fl. oz. water at or above 80°F. and 1, $1\frac{1}{2}$ and 3 oz. respectively below this temperature. At temperatures below 80°F. all the eggs are not destroyed.

PORTER (D. R.). **Insect Transmission, Host Range, and Field Spread of Potato Calico.**—*Hilgardia* **9** no. 8 pp. 383–394, 9 figs., 8 refs. Berkeley, Calif., July 1935. [Recd. January 1936.]

Owing to the prevalence of potato calico in California in 1929 and 1930, studies have been made there of its insect vectors, host range and rate of spread in potato fields, although maximum infection during 1932, 1933 and 1934 was less than 3 per cent., with less than 1 per cent. average for the State. Artificial transmission of the virus effected in Oregon by McKay and Dykstra in 1927 and 1929 was reported in a paper previously noticed [*R.A.E.*, A **20** 569], and successful mechanical inoculations were subsequently made by the author. Insect transmission trials were limited to *Macrosiphum solanifolii*, Ashm., and one variety of potato. A colony of this Aphid taken from potato plants near San Francisco in January 1931 was transferred to young barley plants growing in an Aphid-proof cage. After 2 weeks Aphids from this colony were fed for 2 days on healthy

or infected potato plants and then for 2 days on other healthy plants. The Aphids from the infected plants induced the disease in 19 of the 25 healthy plants on which they were fed, and of 15 plants exposed to Aphids from the healthy potato plants none contracted the disease. Other Aphid transmission tests in March 1931 and February 1932, in which two different procedures were used, were also successful.

Besides several varieties of potato, a list of which is given, the disease was mechanically transmitted to tomato, pepper (*Capsicum annuum*), egg-plant (*Solanum melongena*), *Datura stramonium* and *Petunia* sp. Data on the rate of field spread in 3 localities show that it is much more rapid on early planted stock. The scarcity of Aphids, which are seldom active during the high summer temperatures prevalent there in July, August and September, contributes to the absence of severe infection in late-planted stock. Tubers of plants that become infected when nearly mature may be free of the virus, but the rate of movement of the virus from the leaflets to the tubers is unknown, and in the author's experiments the disease remained tuber-perpetuated during 6 successive generations of potato plants and seedlings.

HASEMAN (L.). **The Hessian Fly and its Control.**—*Circ. Mo. agric. Exp. Sta.* no. 188, 4 pp., 1 map. Columbia, Mo., September 1935. [Recd. February 1936.]

In view of increasing injury to wheat in Missouri by the Hessian fly [*Mayetiola destructor*, Say], brief notes are given on its bionomics and control.

Eggs are laid on the surface of the blades of wheat. After hatching, the larvae burrow behind the leaf sheath to feed, and attack the stem. Up to 50 may pupate on a plant. Two main broods occur in the year, one in September and early October and the other in the spring. Small secondary broods probably occur after each of these, and in the summer. The larvae damage young wheat both in spring and autumn, and seriously infested plants are dwarfed. The summer is passed in the pupal stage in the stubble. All infested stubble should be ploughed under, 6–8 ins. deep, soon after harvest, in July if possible, and the ground dragged, harrowed or disked to close the crevices and to make the surface firm, to prevent the emergence of adults. Fields of wheat which have been destroyed because of infestation should not be resown before the stubble has been ploughed under, nor should clover be grown over infested wheat stubble, since the flies emerge and lay on the young crops. Self sown wheat should be destroyed. All wheat should be sown at or after the date recommended, which varies from the 1st October in the north of the State to 18th October in the south. Winter barley and rye may be sown a little earlier, as the fly does not breed so freely on them. Since it may migrate 2 miles before laying its eggs, co-operation between farmers is necessary.

HASEMAN (L.). **Insect Pests of the Household.**—*Bull. Mo. agric. Exp. Sta.* no. 356, 27 pp., 12 figs. Columbia, Mo., November 1935.

Notes are given on the appearance and habits of, type of injury caused by, and methods of controlling the chief insect and other pests of the household in Missouri. These are dealt with under general

headings, including insects (termites and Coleoptera) that attack the timber of houses, those that attack clothing, rugs and upholstered furniture, and pests of foodstuffs [*cf.* also *R.A.E.*, B **24** 84].

YOUNG (M. T.). **Bollweevil Control with Calcium Arsenate on Field Plots in Madison Parish, La., from 1920 to 1934.**—*Tech. Bull. U.S. Dep. Agric.* no. 487, 24 pp., 3 figs. Washington, D.C., October 1935.

An account is given of field tests to determine the effectiveness of calcium arsenate dusts for the control of the cotton boll-weevil, *Anthonomus grandis*, Boh. The tests took place from 1920 to 1934 in north-eastern Louisiana, where conditions are favourable for the insect. Calcium arsenate was generally used according to the standard method [*cf. R.A.E.*, A **22** 636, etc.], dusting being started when 10 per cent. of the squares were punctured and continued at 4–5 day intervals as long as was necessary to keep the weevils under control, particularly during the heavy fruiting period. Occasionally treatment was begun earlier and continued longer. From 4 to 17 tests were made every year. Test plots and control plots were alongside one another. The area for picking, after the outer rows had been rejected as a buffer, varied from about 0·2 to 0·5 acres. The average quantity of calcium arsenate applied per acre in one application varied from 4·74 lb. to 11·63 lb. When it was necessary to start dusting early in the season more applications were required.

Over the period of 15 years, the average weekly infestation of cotton squares varied from about 10 per cent. in June on both treated and untreated plots, to about 47·5 per cent. on untreated and 22 per cent. on treated plots in August. The average increase in yield per acre for the treated plots ranged from 10 lb. in 1924 to 742 lb. in 1926 with an average of 356 lb. or 30·2 per cent. over the complete period. In a few cases treated plots yielded less seed-cotton than untreated ones.

Tests made in 1920 showed that for early, intermediate and late infestations, the average increase in yield of treated over untreated plots was 43·9 per cent., 34·5 per cent. and 32·8 per cent. respectively. With later infestations more cotton was produced on both treated and untreated plots.

Tests in 1927 on cotton planted at the usual time on unflooded land, and planted late, after flood waters had receded from the fields, indicated that the older cotton was first attacked and the young cotton only became heavily infested when the weevils migrated. The average increase in yield of treated over untreated plots was greater on the cotton planted at the normal time.

In 1928 the average infestation of squares on untreated plots was 5·0–22·1 per cent. less in fields planted with cotton for the first time than in those that had also been planted with cotton in 1927. The percentage increase in yield of treated over untreated plots was 36·1 in the first case and 45·7 in the second.

In two special tests in 1932 dusting was begun much later, when migration was in progress and the infestation of cotton squares was about 88 per cent. After 7 weeks of treatment, infestation was about the same on undusted plots and 49 and 59 per cent. on the dusted ones. More calcium arsenate was used per acre as the plants were larger. The increase in yield due to dusting was 75·7 and 319·3 per cent.

Dusting complete fields is more efficient than dusting separate plots, since the weevils tend to migrate into the latter from untreated fields. The average percentage increase in yield is closely correlated with the number of days from 21st June to 19th August with a precipitation of 0·3 ins. or more, and to a less extent with the total precipitation during this period, and the minimum temperature of the preceding winter.

PEARCE (G. W.), NORTON (L. B.) & CHAPMAN (P. J.). **A Chemical Method for determining the Safeness to Foliage of Commercial Calcium Arsenates.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* no. 234, 15 pp., 1 diagr., 11 refs. Geneva, N.Y., October 1935. [Recd. February 1936.]

It has been shown [*cf. R.A.E.*, **21** 613] that neither gross composition nor water-soluble arsenic content are satisfactory criteria of the degree of injuriousness of calcium arsenate to foliage. However, the water-soluble arsenic content determined after the commercial product had been treated with carbon dioxide [*cf.* **22** 406] seemed to be related to foliage injury. This was proved to be due to the removal of free lime, because treatment with hydrochloric acid, phenol, oxalic acid, and the leaching of the lime with water or benzoic acid had the same effect. In the standard test, the commercial powder was suspended in water and titrated with carbon dioxide solution, using an alcoholic solution of thymolphthalein as indicator. The water-soluble arsenic was determined in a convenient aliquot of the filtrate of this mixture. In 16 commercial products the water-soluble arsenic content varied from 0·20 to 11·50 per cent. Field tests on beans that had been carried out on 10 of the products [*cf.* **23** 331; **21** 613] showed that for safe use on foliage not more than 0·75 per cent. of water-soluble arsenic should be present after treatment with carbon dioxide solution, and for intermediate use (moderate scorching under most conditions) not more than 2·50 per cent. Other quantities that could be correlated with injury to the foliage after free lime had been removed from the product were the water-soluble lime in that product, and the reserve alkalinity (the amount of acid required to neutralise a given volume of the filtrate from which the water-soluble arsenic was determined). These might more easily be affected by the addition of spreaders and stickers.

The water-soluble arsenic responsible for injury to the leaves is probably mostly derived from the soluble compounds of calcium and arsenic in the powder and not from the breaking down of insoluble compounds by carbon dioxide.

SHOPE (P. F.). **Paradichlorobenzene as a Herbarium Insecticide.**—*Science* **83** no. 2140 p. 19, 1 ref. New York, 3rd January 1936.

The author has obtained successful control of insect pests in herbaria by the use of paradichlorobenzene, but he advocates placing the crystals on the top shelves of the cases instead of on the bottom, as suggested in a previous paper [*R.A.E.*, A **23** 374], since the fumes are heavier than air.

Alexander (A. E.). **Termites in Central New York State.**—*Science* 83 no. 2141 p. 34. New York, 10th January 1936.

A nest of *Reticulitermes flavipes*, Kollar, was found in 1933 at Ithaca (New York), this being a new northern record for this termite.

Granett (P.). **Derris Insecticides. IV. Further Studies on the insecticidal Properties of Derris Root Residues extracted with different Solvents.**—*Bull. N. J. agric. Exp. Sta.* no. 583, 12 pp., 7 refs. New Brunswick, N.J., February 1935. [Recd. February 1936.]

The following is substantially the author's summary: Samples of ground derris root were extracted with water-soluble solvents such as ethyl alcohol, acetone, and acetic acid, and water-insoluble solvents such as ethyl acetate, carbon tetrachloride, benzene, chloroform, and ether. Secondary extracts were obtained by re-extracting the residue left in the root with another solvent. In some cases the residue left on re-extraction was still further extracted with another solvent. The extracts were used to determine the percentage of total extractives present. The exhausted residues and certain of the extracts were tested on *Aphis rumicis*, L., and silkworms (*Bombyx mori*, L.).

It was concluded that ethyl alcohol was the only solvent that removed practically all the insecticidal substances from the root, leaving a residue that had little if any toxic effect. All the residues tested, except that from the alcohol extraction, deterred the silkworms from feeding on dusted leaves. The percentage of total extractives obtained varied with the type of organic solvent used, water-soluble solvents tending to extract more total solids from the root than water-insoluble ones. The removal of a large percentage of total extractives by a solvent does not always indicate, however, that the latter can extract the insecticidal principles more efficiently. The water-soluble solvents also extracted more of the active insecticidal ingredients, as the residues left after extraction had no toxic effect on the Aphids and silkworms. Re-extraction with the same solvent for more than 10 hours removed very little, if any, additional solids or insecticidal material from the root. Secondary extraction with a water-soluble solvent of a residue that was previously extracted with a water-insoluble solvent removed more insecticidal constituents.

Burdette (R. C.). **The Biology and Control of the Pepper Maggot *Zonosemata electa* Say. Trypetidae.**—*Bull. N.J. agric. Exp. Sta.* no. 585, 31 pp., 34 figs., 20 refs. New Brunswick, N.J., January 1935. [Recd. February 1936.]

An account is given of the biology of *Zonosemata electa*, Say (pepper maggot fly), which is a serious pest of pepper (*Capsicum annuum*), particularly of the "squash" variety, in New Jersey, and also infests egg-plant (*Solanum melongena*) and horse-nettle (*Solanum carolinense*). The adult flies are found from 20th June to 12th August in southern New Jersey and from 25th June to 25th August in central New Jersey. Of flies caught in the field only 12–19·5 per cent. were females, the proportion increasing when the temperature rose to about 70°F., but in 1931 and 1932 approximately equal numbers of both sexes emerged (from 29th June to 24th July and from 25th June to 12th July respectively). In captivity the adults lived more than a week when

in the shade and fed on sweetened water. Females would not oviposit in captivity but probably lay about 40–50 eggs in the field, in pepper fruits ½–1½ ins. in diameter [*cf. R.A.E.*, A **12** 47]. Occasionally the epidermis of the pepper is punctured, and no eggs are placed in the hole. The maximum number of flies and the greatest oviposition occur from 1st July to 20th July in the south and from 15th July to 10th August in central New Jersey. After hatching the larvae feed on the inner surface and placenta of the pepper. Full-grown larvae are found from 15th July to the end of September, mostly in late August and early September They leave the fruit to pupate and hibernate in the soil. In experiments in which puparia were buried in soil, flies emerged from 25·8 per cent. at a depth of 1½ ins. and from 11·1 per cent. at a depth of 10 ins.

Peppers picked when red show injury and start to rot within a few days. Those picked when green show little injury until they redden. The degree of infestation is less towards the end of the summer, when the number of peppers increases and the number of flies decreases. In dusting experiments using lime as carrier, repellents such as nitronaphthalene, dinitrotoluene, beta-naphthol, and cresylic acid used at a strength of 1 per cent. lost effect after a day. In experiments on the use of talc dusts [*cf.* **18** 410], the dust was applied weekly at the rate of 25 lb. acre, and re-applied after rain. Generally about 7 applications were sufficient, from 1st July to 15th August in the centre and from 20th July to 5th August in the south of New Jersey. Hand rotary dusters were used, as power dusters did not give such good control. Flies were observed to avoid the dusted rows and to gather on the undusted ones. Dusted rows produced 3–44 per cent. less infested peppers, infestation on control rows being 3·3–58 per cent.

Tests were made of a bait-spray of 6 lb. syrline (75–81 per cent. total sugar, 40 per cent. of which is invert) and 1 lb. zinc arsenite in 50 U.S. gals. water [*cf.* **20** 422] applied at the rate of about 2 U.S. gals. per acre per application to every tenth row of plants in an 8-acre field. The spray was applied 9–14 times, according to the number and infestation of peppers in different parts of the field, from 8th to 29th July. The percentage infestation was greatly reduced ; on 31st August it was 11·6 on the sprayed block and 46·3 on an unsprayed one. When 15–20 lb. syrline were used to 50 U.S. gals. water, a sticky film was deposited on the plant, which remained until removed by the rain. This might reduce the number of applications necessary.

Service and Regulatory Announcements July-September 1935.—*S.R.A. B.E.P.Q.* no. 124, pp. 49–68. Washington, D.C., December 1935.

In an announcement relating to Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.] in the United States, instructions are given for the use of paradichlorobenzene for treating soil round the roots of certain species of *Azalea*. The paradichlorobenzene should be mixed with moist, friable soil low in organic matter, and freed from lumps and stones by sifting through a ½ inch mesh screen. This soil should contain 6 oz. paradichlorobenzene per cu. ft. for treating soil balls or earth round roots of potted plants up to 6 ins. in diameter, or 12 oz. per cu. ft. for those between 6 and 8 ins. in diameter, and should be mixed just before use. The pots or burlap covering the soil balls should be removed and the plants placed in

a row with the soil balls about 1 inch apart. The spaces between should be filled with the treated soil and the soil balls covered to a depth of about 1 inch. The temperature should be between 50 and 65°F., and the soil balls moist but not wet. The plants should be left undisturbed for 5 days, during which period they should not be watered. Then they should be removed and watered.

Plant quarantine restrictions issued in Greece, Palestine, the Russian Union, the Bahamas, Brazil, Haiti, St. Kitts & Nevis, and Uruguay are quoted or summarised.

Gomez Menor (J.). **Algo sobre hormigas y medios para combatirlas.** [Some Notes on Ants and Means for combating them.]—*Rev. Agric. Com. S. Domingo* **27** no. 73 pp. 2051–2053, 2090, 2 figs. S. Domingo, October 1935. [Recd. January 1936.]

This is a popular article on the bionomics and control of ants, of which the species troublesome in Santo Domingo include *Solenopsis geminata*, F., *Monomorium pharaonis*, L., *Pheidole megacephala*, F., and *Paratrechina* (*Prenolepis*) *longicornis*, Latr.

Gomez Menor (J.). **Insectos que atacan al Roble.** [Insects attacking Catalpa.]—*Rev. Agric. Com. S. Domingo* **27** no. 74 pp. 2109–2110, 2 figs. S. Domingo, November 1935.

The leaves of *Catalpa longisiliqua* in Santo Domingo are attacked by the larvae and adults of the Cassidid, *Batonota humeralis*, Ol., and the larvae of the Noctuid, *Hyblaea puera*, Cram. The eggs of *B. humeralis* are attached in batches of about 20 to branches ready to put forth leaves and hatch in 3–5 days. About 15 per cent. of them are parasitised by a Eulophid. *H. puera* lays its eggs singly, and the larval stage lasts 10–15 days. Both pests may be controlled with a lead arsenate spray, which may be combined with Bordeaux mixture against a fungus, *Prospodium* sp. A Diaspine scale on the trunks and older branches may be checked with a lime wash containing phenol.

Wolcott (G. N.). **Report of the Entomologist.**—*Rep. P. R. agric. Exp. Sta. 1933–34* pp. 142–144. S. Juan, P.R., 1935.

Much of the information in this report on entomological work in Porto Rico in 1933–34 has already been noticed in greater detail [*R.A.E.*, A **23** 112–114 ; **24** 3]. Although cotton is no longer grown commercially, *Platyedra* (*Pectinophora*) *gossypiella*, Saund., is still present, infestation being 20–25 per cent. in a field of sea island cotton in September 1933. The crop was destroyed, but in April 1934, 4 out of 50 ripe pods of maga [*Montezuma speciosissima*] were found to be infested with the larvae. *Icerya purchasi*, Mask., has spread very little on *Citrus*, etc., during the year in spite of the dry spring, the only new infestations being on individual trees in two localities. The introduced predacious Coccinellid, *Rodolia cardinalis*, Muls. [*cf.* **22** 152], is fairly generally established. Outbreaks of *I. montserratensis*, Ril. & How., occurred in two localities, and *R. cardinalis* was liberated in one of them. *Lyncestis* (*Melipotis*) *acontioides*, Gn., defoliated flamboyant trees [*Poinciana*] in August and then entered houses nearby in search of food. Parasites of *Leucoptera coffeella*, Guér., on coffee

were *Chrysocharis livida*, Ashm., and *Horismenus cupreus*, Ashm., which were the most abundant, and *Derostenus* sp., *Elachertus* sp., and *Tetrastichus* sp. With the exception of *C. livida*, these are all recorded for the first time.

SQUIRE (F. A.). **Annual Report of the Entomological Division for 1934.**—*Divl Rep. Dep. Agric. Brit. Guiana 1934* pp. 121–124. Georgetown, 1935.

Insect pests were exceptionally scarce in British Guiana during 1934. The Dynastids, *Dyscinetus geminatus*, F., and *D. bidentatus*, Burm., were not recorded on sugar-cane, probably because the abnormally heavy rainfall in January killed large numbers of larvae. The sugar-cane Aphid previously recorded as *Sipha flava*, Forbes [*R.A.E.*, A **23** 145] has now been identified as *Aphis* (*Rhopalosiphum*) *sacchari*, Zehnt. It was absent during the year probably owing to the low and unevenly distributed rainfall. In experiments to protect stored rice from injury by the rice weevil [*Calandra oryzae*, L.], 1 lb. calcium carbonate per 180 lb. rice and sodium fluosilicate at the rate of 0·07 per cent. by weight [*cf.* **23** 395] were effective for at least 8 months. *Athaumastus laetus*, Mayr, has been reported on pineapple in a locality further inland. The parasite, *Hadronotus rugosithorax*, Ashm., was also present, and in one case parasitised 93 per cent. of the eggs. Several slight outbreaks of *Brassolis sophorae*, L., occurred on coconut. The Eumolpid, *Colaspis hypochlora*, Lef., caused severe and widespread damage to bananas on the coast. It burrows into the rolled-up, young leaves and also attacks the flowers and fruits. The latter may become reduced in size and disfigured with black scars. No immature forms of the beetle were found, and the outbreak died out in 3–4 weeks.

Atta cephalotes, L., *A. insularis* subsp. *mexicana*, F. Sm. (*A. fervens*, Say), *A. laevigata*, Smith, and *Acromyrmex* (*Atta*) *octospinosus*, Reich., are particularly destructive to vegetable crops. They are extremely difficult to control in sandy regions where the soil does not hold gases well. An unidentified Scolytid was found attacking British Honduras mahogany trees [*Swietenia humilis*] in the north-west. It breeds in the bark and is so numerous that when emergence takes place the trunk and the larger branches are covered with about 15 holes to the square inch. Six trees were attacked, and all were killed. The larvae are parasitised by *Chaetospila elegans*, Westw. Several West Indian mahogany trees [*S. mahagoni*] growing wild were also attacked. The Scolytid, *Coccotrypes dactyliperda*, F., was reported destroying buttons made from the Doum nut palm (*Hyphaene* sp.). The beetle bred in the buttons and left only a thin outer shell. The Hesperiid, *Pyrrhopyge amyclas*, Cram., is recorded as defoliating guava.

DO AMARAL (A. P.). **A lagarta rosada e a necessidade do tratamento previo das sementes do algodão.** [The Pink Bollworm and the Need for the Disinfestation of Cotton Seed.]—*Campo* **6** no. 12 pp. 28–29. Rio de Janeiro, December 1935.

The pink bollworm [*Platyedra gossypiella*, Saund.] has recently reappeared in numbers in the cotton fields of São Paulo, where it had not been very injurious since the first outbreaks were observed nearly 20 years ago. Besides the removal and destruction of all crop remnants,

the cotton seed must be disinfested, the method advocated in preference to any other being immersion for 30 minutes in a 1 per mille solution of mercury bichloride just before sowing. Even if left in the solution for 7–10 days, the seed has been found to have a high percentage of germination.

Monte (O.). **Um pouco de historia sobre** *Metagonistylum minense*. [Some historical Notes on *M. minense*.]—*Campo* **6** no. 12 pp. 30–31, 1 fig. Rio de Janeiro, December 1935.

The author states that he was the first to rear the Tachinid, *Metagonistylum minense*, Tns., from *Diatraea saccharalis*, F., from which he obtained it in 1931 in Minas Geraes [*cf. R.A.E.*, A **22** 187, 566]. This Tachinid was first described from Minas Geraes in 1926.

Bosq (J. M.). **Primera lista de los coleópteros de la República Argentina dañinos á la agricultura.** [A first List of Argentine Coleoptera harmful to Agriculture.]—*Bol. Minist. Agric. Nac. Argent.* **36** no. 4 pp. 313–346. Buenos Aires, 1934. [Recd. February 1936.]

This list includes 316 species and shows the distribution of each in Argentina and the type of injury it does. An index to the plants attacked is appended.

Smith (K. M.). **Plant Viruses.**—F'cap 8vo, ix + 107 pp., 1 pl., 10 figs., 107 refs. London, Methuen & Co., Ltd., 1935. Price 3*s.* 6*d.*

This book opens with a brief survey of the history and economic importance of virus diseases of plants. Subsequent chapters are devoted to the technique of the study of plant viruses, their nature, modes of transmission, and classification by their effect on the plant, the virus in the plant and the insect vector, the control of virus diseases of plants, and the immunity of certain species of plants to a virus that affects closely related species. Plant and animal viruses are compared.

Kanervo (V.). *Eumerus tuberculatus* **Rond. (Dipt., Syrphidae), maalle uusi laji sipulituholaisena.** [*E. tuberculatus*, an Onion Pest new to Finland.]—*Suom. Hyönteistiet. Aikakausk.* **1** no. 3 pp. 101–106, 11 figs. Helsingfors, 1935. (With a Summary in German.)

In 1934 *Eumerus* spp. were about 9 times as numerous in onions in Finland as *Hylemyia antiqua*, Mg. Of some 2,000 individuals from various localities, about 40 per cent. were *E. strigatus*, Fall., and 60 per cent. *E. tuberculatus*, Rond. The latter had not been recorded from Finland before, but occurred in material collected 20 years previously when it was misidentified as *E. strigatus*. Both species do considerable injury to onion in Finland, where their larvae have also been found in potato, cabbage, and radish. They have a similar life-history. The majority hibernate as larvae, though some do so as pupae. The adults appear at the end of June and early in July. The eggs hatch in 3–5 days, larval development requires 4–6 weeks, and the pupal stage lasts 1½–3 weeks. One generation a year is the rule, but in southern Finland and in abnormally warm summers in the north there may be a partial second generation.

Pohjakallio (O.). **Ueber die Weissährigkeit der Gramineen.** [On "White Ear" of Graminaceous Plants.]—*Maataloust. Aikakausk.* **7** pp. 102–103. Helsingfors, 1935.

Hukkinen (Y.). **Ueber die Weissährigkeit der Gramineen.**—*T.c.* pp. 104–106.

In these papers vexed questions relating to Hukkinen's survey of the problem of the causes of "white ear" of grasses and cereals [*R.A.E.*, A **23** 261] are discussed.

Prüffer (J.). **Szkodniki zbóż obserwowane w roku 1932 i 1933.** [Pests of Cereals observed in Poland in 1932 and 1933.]—*Roczn. Ochr. Rośl.* (B) **2** fasc. 2–3 pp. 21–33. Warsaw, 1935. **Szkodniki śpichrzów i młynów w r.1932 i 1933.** [Pests of Granaries and Mills in 1932 and 1933.]—*T.c.* pp. 35–37.

Ruszkowski (J. W.). **Szkodniki śpichrzów i młynów w r.1931.** [Pests of Granaries and Mills in 1931.]—*T.c.* p. 34. **Szkodniki buraków obserwowane w r.1931.** [Pests of Beet observed in 1931.]—*T.c.* pp. 38–39. **Szkodniki drzew leśnych obserwowane przez polskie stacje ochrony roślin w roku 1931.** [Pests of Forest Trees observed by the Polish Stations of Plant Protection in 1931.]—*T.c.* pp. 177–185.

Krasucki (A.). **Szkodniki buraków obserwowane w r.1932 i 1933.** [Pests of Beet observed in 1932 and 1933.]—*T.c.* pp. 40–44.

Ruszkowski (J. W.), Krasucki (A.) & Pronin (J.). **Szkodniki chmielu obserwowane w latach 1931–1933.** [Pests of Hops observed in 1931–33.]—*T.c.* pp. 45–46.

Ruszkowski (J. W.) & Krasucki (A.). **Szkodniki tytoniu obserwowane w latach 1931–1933.** [Pests of Tobacco observed in 1931–33.]—*T.c.* p. 47.

These papers comprise lists of pests, chiefly insects, recorded from various districts in Poland, with brief notes on their local distribution and abundance. An index (pp. 220–232) to the scientific and popular names of the pests in these lists and those already noticed [*R.A.E.*, A **24** 21, 88] is appended.

Pic (M.). **Pour la récolte du doriphore.**—*Echange* **51** no. 461 pp. 9–10. Moulins, 2nd August 1935. [Recd. February 1936.]

The author cleared his potato fields of *Leptinotarsa decemlineata*, Say, during an invasion of Saône-et-Loire in 1935 by means of a large net, on a wire arc, with a short handle. This was pushed over the infested plants and the insects were knocked into a linen pocket in the net.

Salt (G.). **Miscellaneous Records of Parasitism. I.**—*Ent. mon. Mag.* **72** no. 860 pp. 9–12, 3 refs. London, January 1936.

In November 1930 a number of aphidophagous Syrphid larvae were collected from cabbages and artichokes (*Cynara scolymus*) in a locality in the Alpes-Maritimes, France, and allowed to pupate. Of 343 puparia of *Syrphus balteatus*, DeG., 34 were parasitised by *Bassus laetatorius*, F., and 29 by *Pachyneuron formosum*, Wlk., which are primary parasites, and 1 by *Homocidus tarsatorius*, Panz. In one case *P. formosum* was hyperparasitic on *B. laetatorius*. The latter was also reared from

puparia of 3 other unidentified Syrphids from the same source. The number of adults of *Pachyneuron* that emerged from a single puparium of *S. balteatus* varied from 1 to 22. Of 25 puparia of *S. auricollis*, Mg., 2 were parasitised by *Callaspidia dufouri*, Giraud, and 2 by *Microterys aeruginosus*, Dalm., both of which are probably primary parasites.

Two parasites of *Cephus pygmaeus*, L. (wheat-stem sawfly) are recorded from Seine-et-Oise. A single example of *Hemiteles hemipterus*, F., was found as a first-instar larva on 7th October 1930 and emerged as an adult in the laboratory on 7th November. A full-grown larva and 3 cast skins of *Gambrus tricolor*, Grav., were found together with the remains of *C. pygmaeus* in a cocoon of the latter on 6th October 1930. The larva had spun a cocoon in the laboratory on 16th October and an adult female emerged on 22nd. Although only one adult was reared from over 110,000 stalks infested with *C. pygmaeus* in England [*R.A.E.*, A **20** 95], one was found in only 9 infested stalks in France. It may be a much more important parasite of *Cephus* there.

Austin (M. D.) & Pitcher (R. S.). **A Laboratory Method for rearing *Sciara* and Phorid Flies.**—*Ent. mon. Mag.* **72** no. 860 pp. 12–15, 1 fig. London, January 1936.

An account is given of a method of rearing species of *Sciara* and Phorids that attack cultivated mushrooms in Kent, particularly *S. fenestralis*, Zett., in small glass tubes open at both ends and plugged at the bottom end with cotton-wool on which a layer of sterilised stable manure 1 cm. thick is placed. The surface of the manure must be level so that eggs are laid on it and not deep down. A pair of flies is placed in each of the tubes which are then kept in the dark. The female usually dies within a week after pairing and oviposition. If it is necessary to add moisture, the cotton-wool plug is removed and the manure damped from below. Hatching and the immature stages can be studied in the same tube or on watch-glasses fitted with a glass cover and containing finely-powdered sterilised manure. To study ecdysis, individual larvae are placed in circular glass cells in which the humidity is maintained by placing moistened powdered sterilised manure on a circle of filter paper in each. As excessive drying out occurs when these cells are kept in an incubator, they are first put in a flat tin containing a layer of damp sand covered with blotting paper. The latter and the filter paper in the cells require moistening occasionally, and the food is renewed as required.

Laing (F.). *Anoncodes melanura* **L. as a destructive Insect.**—*Ent. mon. Mag.* **72** no. 860 pp. 15–17, 1 fig. London, January 1936.

Blair (K. G.). **A further Note on *A. melanura* L.**—*T.c.* pp. 17–18.

In the first paper brief notes are given on the occurrence of the Oedemerid, *Nacerda* (*Anoncodes*) *melanura*, L., in England in timber and along river banks, etc. Over 100 larvae were found in a piece of wood 6 ins. square in a greenhouse at Wisbech, and the benches were falling to pieces. At Guildford larvae were found in a piece of timber that was inadvertently left 7 years before in a mass of concrete forming a well-head. Although there was no exit to the surface, the insect had continued to breed and the wood was riddled with borings. The wood was coniferous, but on the continent oak has also been

attacked. In Germany K. E. Schedl has reported damage to the floor boards of a lighter standing clear of the water [*R.A.E.*, A **22** 348], and this may partly explain the presence of the beetle in areas adjoining canals. It is possible that it has been distributed on barges.

In the second paper the author records further instances of the occurrence of this beetle. The cavities in which the larvae live are relatively large and are probably due in part to decay of the wood, not entirely to excavation by them.

PETHERBRIDGE (F. R.) & THOMAS (I.). **Further Experiments on the Control of Flea Beetles in Seed-Beds.**—*J. Minist. Agric.* **42** no. 11 pp. 1086–1088, 1 pl., 2 refs. London, February 1936.

In 1935 experiments on the control of flea-beetles [*Phyllotreta*] in crucifer seed-beds were carried out in Bedfordshire in order to compare the derris dusts that gave good results in 1934 and the naphthalene and silica dust used by Miles [*R.A.E.*, A **23** 221] with a proprietary dust of finely powdered quartz that is used in Germany. The first two were applied at the rate of about 75 lb. per acre and the quartz at about 140–150 lb. per acre. The first dusting was given when the plants were just coming through the ground followed by 3 or 4 applications at intervals of 2 or 3 days depending on the weather. The derris and naphthalene-silica dusts gave very good control; the powdered quartz gave some measure of protection, but the plants treated with it were often little better than those on the untreated plots. The average number of plants per foot in the control and on plots dusted with derris, naphthalene-silica, and powdered quartz were 3·0, 8·7, 9·2 and 6·8, respectively, in one locality and 2·1, 9·9, 9·0 and 3·0 in another.

FRYER (J. C. F.). **Colorado Beetle at Tilbury. III.**—*J. Minist. Agric.* **42** no. 11 pp. 1089–1092, 2 refs. London, February 1936.

From mid-May to the end of June 1935, the areas that had been infested with the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] in 1933–34 [*cf. R.A.E.*, A **23** 220] and all potato crops within a radius of 10 miles and some more distant ones in Essex and Kent were thoroughly inspected. The district round Tilbury and Gravesend was kept under observation until the end of the season. No trace of the beetle was discovered.

On 2nd July a living adult that had apparently emerged since the winter was found on a lighter alongside the Surrey Commercial docks in London. The lighter was moored not far from two vessels that had just arrived from ports in the southern United States, and it is quite probable that the beetle had been brought on one of these although neither was carrying potatoes or agricultural produce likely to harbour it. No further individuals were found. The author points out how easily *Leptinotarsa* might be introduced at any port on vessels from France or America, and he stresses the need for vigilance and the value of the assistance that can be given by members of the public. In view of the progress made by the beetles in Europe and their tendency to migrate it would not be impossible for them to fly across the Channel in favourable weather.

Petherbridge (F. R.) & Thomas (I.). **The Control of Plum Sawfly (with a Note on Thrips Damage).**—*J. Minist. Agric.* **42** no. 11 pp. 1108–1118, 2 pls., 3 refs. London, February 1936.

In view of serious losses in the crop of plums and damsons caused by *Hoplocampa flava*, L., in the eastern counties of England, experiments on its control were carried out in 1933–35. Two applications of a spray of 0·8 lb. derris and 5 oz. spreader in 40 gals. water gave rather better results than two of 10 oz. nicotine sulphate, 1–3 lb. lead arsenate, and 5 oz. spreader in 40 gals. water. The amount of lead arsenate used was 1½ lb. in 1933, 3 lb. in 1934 and 1 lb. in 1935. In 1934 and 1935 the percentages of damaged fruit were 5·7 and 9·9 on plum trees sprayed with derris and 7·3 and 10·0 on those sprayed with nicotine sulphate and lead arsenate, as compared with 22·9 and 71·5 on the controls, respectively. The corresponding percentages on damson trees were 5·2, 6·5 and 16·7 in 1933, and 8·7, 33·3 and 85·1 in 1935. The first spray was applied when the receptacles were beginning to split and the second about a week later. In a single test, one spray when the receptacles began to split gave better results than one spray a week later, the percentages of infested fruit being 33·7 and 48·3 on damson trees sprayed with nicotine sulphate and lead arsenate on 7th and 16th May, respectively. Nicotine sulphate or lead arsenate used alone were not satisfactory, nor was one application of a derris dust (0·2 per cent. rotenone). Three dustings with 30 per cent. naphthalene reduced the infestation, probably by driving the sawflies to other trees, as it does not destroy them.

In the course of the investigation it was observed that plums on unsprayed trees were damaged by *Taeniothrips inconsequens*, Uzel. The percentage of damaged plums was reduced from 27·5 on the control to 1·7 on trees sprayed with the nicotine sulphate and lead arsenate mixture in 1933. In 1935 the percentage of damsons marked by thrips was 43 on the control trees and 29 on the sprayed ones.

Ziekten en beschadigingen van het aardappelloof. [Diseases of and Injuries to Potato Foliage.]—*Versl. PlZiekt. Dienst* no. 6, 7th revd edn, 32 pp., 9 pls. Wageningen, November 1935.

Notes are given on the following insects harmful to potato foliage: *Leptinotarsa decemlineata*, Say, which has not yet been recorded in Holland, but which might be introduced [*cf. R.A.E.*, A **21** 85; **23** 355, etc.]; cutworms, against which an arsenical spray or a poisoned bran bait is advised; *Plusia gamma*, L., which may be controlled by an arsenical spray; *Hydroecia micacea*, Esp., for which no measure is given; and leaf-bugs, small infestations of which may be checked by dusting with pyrethrum.

Blijdorp (P. A.). **Resultaten van het karwijmot-onderzoek in Groningen.** [The Results of the Caraway Moth Investigations in Groningen.]—*Versl. PlZiekt. Dienst* no. 82, 20 pp., 6 figs., 1 pl. Wageningen, December 1935.

The investigations begun in 1933 on the caraway moth [*Depressaria nervosa*, Haw.] in Holland [*R.A.E.*, A **22** 270; **23** 481] have now been concluded. The results as regards control are recorded here, it being intended to publish a separate paper on the biology of the moth.

Infestation becomes severe only where caraway is extensively grown, and a decrease in caraway cultivation results in a fall in its incidence to a proportionately greater degree. Where an insecticide is used, it is almost always better applied as a dust than as a spray, that advocated being derris of known rotenone content diluted with French chalk (talc). The fields should be inspected at the end of March, and if a count over a few square yards indicates the presence of more than 6–8 thousand females per acre dusting is worth while. The terminalia are figured to enable the grower to distinguish the sexes.

Deshusses (J.) & Deshusses (L.). **A propos de** *Phytomyza continua* **Hend., parasite des endives.**—*Mitt. schweiz. ent. Ges.* **16** no. 6–7 pp. 445–446. Bern, 14th August 1935. [Recd. January 1936.]

The authors recorded *Phytomyza continua*, Hendel, from Geneva as a pest of endive (*Cichorium endivia*) [*R.A.E.*, A **17** 404]. In a paper already noticed [**21** 215] van den Bruel considered that the record referred to *P.* (*Napomyza*) *lateralis*, Fall., but it is here stated that the latter has not been found in Switzerland and that the original identification was correct.

Eidmann (H.). **Zur Kenntnis der Eiparasiten der Forleule, insbesondere über die Entwicklung und Oekologie von** *Trichogramma minutum* **Riley.** [A Contribution to the Knowledge of the Egg Parasites of the Pine Noctuid, especially on the Development and Ecology of *T. minutum*.]—*Mitt. Forstwirt. Forstwiss.* 1934 no. 1 pp. 56–77, 15 figs., 29 refs. Hanover, 1934. [Recd. January 1936.]

During the outbreak of the pine Noctuid, *Panolis flammea*, Schiff., in Prussia in 1933, *Trichogramma evanescens*, Westw., parasitised about 1 per cent. of the eggs and *Telenomus phalaenarum*, Nees, considerably less. The scanty material of *T. phalaenarum* permitted only a few observations. These showed that one parasite developed in each parasitised egg of *P. flammea*, that its exit-hole was larger than that of *Trichogramma*, and that it parasitised the eggs even at 3·5°C. [38·3°F.], *i.e.*, at a lower temperature than *T. evanescens*, its upper limit being similar to that of the latter. At 18°C. [64·4°F.] starving adults lived only 3 days, whereas those fed on sugar water or diluted honey survived for over 2 weeks.

It was planned to breed *T. evanescens* on a large scale, but certain circumstances resulted in *T. minutum*, Riley, obtained from Canada, the United States and Barbados, forming the bulk of the laboratory material [*cf. R.A.E.*, A **21** 395]. From physiological and morphological differences, which are dealt with in detail, the latter is regarded as specifically distinct from *T. evanescens*. Both species were the subject of comparative observation. *T. minutum* must be regarded as useless in practice against *P. flammea*, as the lower temperature limit of its activity is higher, it is actually less active and it is not well adapted to the German climate. Published information on the duration of development at various temperatures is recorded in a table. Hyperbolic curves show a zero point of development of 11·4°C. [52·52°F.] for *T. minutum* and 2·7°C. [36·86°F.] for *T. evanescens*. The curves intersect at 19°C. [66·2°F.] showing development of *T. minutum* to be quicker above and slower below this point than that of *T. evanescens*.

At 18°C., the approximate durations of the egg, larval, prepupal and pupal stages of both species were 3, 10, 1 and 7 days, respectively. The blackish blue colour of parasitised Noctuid eggs was found to be due to a deposit, probably of excreta, on the inner surface of the shell. When only a few hosts were available, a large number of eggs were laid in each by *T. minutum*, the observed maximum being 44. Five parasites were obtained from an egg in which oviposition had taken place once only. From one unfed, mated female of *T. minutum* 4 males and 44 females were bred. As a rule females represented 90 per cent. of the adults. On an average 9 eggs of *Panolis* were parasitised by each female. They could be effectively parasitised up to the time of hatching, provided that the embryo itself received the parasite egg. Unfertilised and fertilised eggs were parasitised without distinction. On an average 7–9 adults of *T. minutum* emerged from each egg. In the field 3 of *T. evanescens* were usually obtained. Only males were obtained parthenogenetically with *T. minutum*.

Great individual differences were observed in the duration of adult life. In two experiments at 15°C. [59°F.] and 21°C. [69·8°F.] the average life of unfed adults of *T. minutum* was 6 and 2 days. The maximum life of *T. evanescens* was 22 days at 18°C. Experiments with low temperatures showed that adults of *Trichogramma* could withstand individual night frosts, but that prolonged exposure was harmful. The lower temperature limit of activity was 5°C. [41°F.] for *T. evanescens* and 8°C. [46·4°F.] for *T. minutum*. The respective lethal upper limits were 39·5°C. [103·1°F.] and 47°C. [116·6°F.]. *T. evanescens* is generally stated to be extremely polyphagous, but eggs laid by it and by *T. minutum* in those of *Sphinx pinastri*, L., *Lymantria monacha*, L., and *Dendrolimus pini*, L., failed to develop; it was not certain if the females were able to pierce the hard shells of the eggs of *D. pini*. No eggs were laid in eggs of *Thaumetopoea* (*Cnethocampa*) *pinivora*, Treit.

GROSMANN (H.). **Ueber eine neue Tannenlaus** (*Dreyfusia prelli* **nov. spec.**). [On a new Aphid of Silver Fir.]—*Tharandter forstl. Jb.* **86** no. 12 pp. 816–826, 4 figs., 1 diagr. Berlin, 1935.

Two Chermesids, *Chermes* (*Dreyfusia*) *piceae*, Ratz., and *C.* (*D.*) *nordmannianae*, Eckstein, have been recorded hitherto from *Abies* in Germany. A third, which will be dealt with fully elsewhere, is here described as *C.* (*D.*) *prelli*, sp. n., from a park near Dresden, where it alternated between oriental spruce (*Picea orientalis*) and silver firs (*Abies nordmanniana* and *A. cephalonica*), *A. nordmanniana* being the alternative host preferred. Its generation sequence corresponds to the normal pentamorphous Chermesid cycle. The cycle is a two-year one. The progeny of the sistentes on *Abies* occur in two forms. Some develop at once into winged sexuparae that migrate to *Picea* and some resemble their parents, passing the summer as young larvae in a latent state and becoming capable of reproduction only in the following spring. The absence of special summer generations on *Abies* is noteworthy. The galls are described. Up to the time of writing the injury done has been studied only on *A. nordmanniana* and *A. cephalonica*, and it appears to be less serious than that caused by the other two species, which are recorded as definitely harmful to silver fir [*A. pectinata*] in Germany. On oriental spruce the galls are usually on the side buds of young shoots and not on the terminal bud, so that the injury is slight.

On *Abies* the injury to blossom buds and young cones results in loss of the seed. A heavy infestation may stunt the vegetative buds and kill entire shoots and may be a contributive cause where the crowns of older trees wither. *C. prelli* is not a German species, but was probably imported from the Caucasus, where *A. nordmanniana* and *P. orientalis* originated. It has not yet been taken on *A. pectinata*, but oviposited on it in the laboratory and may therefore adapt itself to it, as has *C. nordmannianae*.

Schwartz [M.]. **Anweisung zur Bekämpfung des Kartoffelkäfers.** [Instructions for combating the Potato Beetle.]—*NachrBl. dtsch. PflSchDienst* **16** no. 1 pp. 1–3, 1 map. Berlin, January 1936.

In view of the danger of the potato beetle [*Leptinotarsa decemlineata*, Say] reaching Germany [*cf. R.A.E.*, A **23** 740], detailed instructions are recorded for its complete eradication.

Maier-Bode (—). **Die Gartenhaarmucke** (*Bibio hortulanus*) **als Roggenschädling.** [*B. hortulanus* as a Pest of Rye.]—*NachrBl. dtsch. PflSchDienst* **16** no. 1 p. 10. Berlin, January 1936.

Rye near Berlin and in other parts of Prussia has recently been attacked by *Bibio hortulanus*, L., which sometimes caused losses of 90 per cent. In one instance the injury was observed about 10th November, and an early development of the larvae is suggested as the reason. According to the literature, the injury occurs in spring to wheat that has not yet sprouted above ground, but in the present infestation the rye plants were above ground, sometimes to a height of about 2 inches. The larvae, which occurred at a depth of about 2 inches, attacked the stems below the first node. High-lying fields were those chiefly attacked, and in all reported cases they were near woods. A top dressing of potash was applied to drive the larvae to lower depths, but as subsequent frosts may have killed the larvae no definite estimate of the value of this measure is possible.

Kemper (H.). **Ueber die Anfälligkeit verschiedener Pelzsorten gegenüber Mottenfrass.** [On the Susceptibility of various Furs to Attack by Moth.]—*Anz. Schädlingsk.* **12** no. 1 pp. 1–6, 3 refs. Berlin, January 1936.

An account is given of experiments showing differences in the degree to which different furs are attacked by the clothes moth, *Tineola biselliella*, Humm. None was immune. The differences were chiefly due to the fact that on certain varieties the larvae fed more freely and quickly and had a lower mortality. It would appear that they are unable to complete the whole of their development on some pelts, such as those of rabbit and calf.

Zwölfer (W.). **Der kleine Wespenbock,** *Caenoptera minor* **L., als Gerbrindenschädling.** [*Molorchus minor* as a Pest of Bark used for Tanning.]—*Anz. Schädlingsk.* **12** no. 1 pp. 7–10, 2 figs., 10 refs. Berlin, January 1936.

The Cerambycid, *Molorchus* (*Caenoptera*) *minor*, L., feeds in the sapwood and bark of weakened or dead trunks, branches and logs of spruce. In the autumn of 1935 samples of spruce bark (which is used

for tanning as it contains 10–15 per cent. tannin) were sent in by a Bavarian leather factory, where about 10 per cent. of the stock of bark had been destroyed. The samples contained larvae, pupae and adults of *M. minor* in October 1935, and as the bark was received at the factory in the summer of 1934, a generation must require 1½ to 2 years. The larvae had adapted themselves to feeding in the bark without sapwood; a description of the mines and pupal chambers is given. It is probable that the bark had been infested while it was being dried in the forest after removal from the trunks. It is advised that all bark be examined when brought into the factory and sprayed with Xylamon if found infested.

THIENEMANN (A.). **Eine Chironomidenlarve als Schädling des Rubsensamens ?** [A Chironomid Larva as a Pest of Beet Seed ?]—*Anz. Schädlingsk.* **12** no. 1 p. 12. Berlin, January 1936.

In May 1935 larvae of *Bryophaenocladius* sp. were found feeding in the seeds of sugar-beet sown in a field at Salzmünde, Germany. Larvae of this genus had previously been known only from mosses and earth.

SZELÉNYI (G.). **Observations faites sur la volée de l'*Epicometis hirta* Poda.** [*In Magyar.*]—*Rep. Hung. agric. Exp. Sta.* **37** no. 4–6 pp. 239–243, 1 fig., 3 graphs. Budapest, 1934. (With Summaries in German and French.) [Recd. February 1936.]

The adults of the Cetoniid, *Epicometis hirta*, Poda, cause severe damage to the flowers of fruit trees in Hungary. Since collection is the only available means of control, observations were carried out in 1933 and 1934 to determine the best time for the work. The trees were examined at intervals of 30 minutes from 8 a.m. to 4 p.m., and the beetles taken each time were counted. It was found that they attacked pears and apples almost exclusively; only one beetle was taken in the flower of an apricot, and peaches, cherries and plums were ignored. They were inactive on cloudy or rainy days. The peak of the flight was between 10 a.m. and noon, provided that the weather was clear and sunny, but if the morning was dull, it was deferred until the clouds had dispersed. Trees in full bloom were preferred, and where the petals were falling, the intensity of the flight greatly decreased. It is therefore recommended to collect the beetles between 10 a.m. and 1 p.m., particularly in fine weather and on trees in full bloom.

BARANYOVITS (F.). **Contributions à la biologie de la bruche du pois.** [*In Magyar.*]—*Rep. Hung. agric. Exp. Sta.* **37** no. 4–6 pp. 244–250, 3 figs. Budapest, 1934. (With Summaries in German and French.) [Recd. February 1936.]

An account is given of observations on the bionomics of *Bruchus pisorum*, L., on peas in Hungary. The overwintered adults appear when the peas are flowering. They feed on the stems, leaves and flowers, without causing appreciable damage, and soon pair and oviposit. A female lays 2–4 eggs daily, sometimes for several weeks. Eggs are only laid on pods that contain immature seeds and hatch in 4–8 days. The larva bores directly into the pod through the egg-shell. In Hungary the development of the larval and pupal stages is completed in about 2 months, but 20–60 per cent. of the larvae, particularly the

young ones, die before reaching maturity. This is not due to disease, but to the fact that the larvae can develop only on succulent growing seeds, which are not available when those from the later eggs hatch. No relation was found between the size of the peas and that of the adult beetles.

Della-Beffa (G.). **L'***Oecanthus pellucens* **Scop. dannoso a viti e peschi nei dintorni di Torino.** [*O. pellucens* injurious to Grape Vines and Peaches in the Neighbourhood of Turin.]—*Difesa d. Piante* **12** no. 6 pp. 185–189, 2 pls., 20 refs. Turin, December 1935.

Brief notes are given on the synonymy and distribution of the tree-cricket, *Oecanthus pellucens*, Scop., and the adult is described in detail. Near Turin pairing occurs at the end of August and early in September and is soon followed by oviposition. The shoots and twigs in which the eggs are laid include those of the grape vine, peach, plum, apple and hazel [*Corylus*]. The nymphs hatch early in June and feed almost exclusively on Aphids, mites and insect eggs. The adults appear about mid-August, and also feed mainly on Aphids, mites and small larvae, but sometimes attack foliage, the damage, however, being negligible. When the eggs are laid in large numbers, injury is caused because the shoots wither above the point of oviposition, and in 1934 and 1935 peach and grape-vine in Piedmont were injured in this way. The only measure suggested is cutting off in winter the shoots and twigs below the point of oviposition and burning the cuttings.

Waterston (A. R.). **Partridge** *versus* **Heather Beetle.**—*Scot. Nat.* no. 217 p. 30, 1 ref. Edinburgh, 1936.

The contents of crops of partridges shot in Midlothian in 1935 were found to consist almost entirely of heather beetles (*Lochmaea suturalis*, Thoms.) [*cf. R.A.E.*, A **23** 728]. The crop of a grouse shot at the same drive contained no insects.

Vayssière (P.). **Trois nouveaux** *Stictococcus* **(Hem. Coccidae).**—*Bull. Soc. ent. Fr.* **40** no. 20 pp. 282–287, 2 figs. Paris, 7th January 1936.

Descriptions are given of *Stictococcus aliberti*, sp. n., from cacao in French Togoland, and *S. hargreavesi*, sp. n., and *S. olivaceus*, sp. n., from cola nuts in Sierra Leone.

Cottier (W.). **A Re-Description of** *Pseudococcus cocotis* **Maskell, including a Description of the Male (Hem.).**—*Proc. R. ent. Soc. Lond.* (B) **5** pt. 2 pp. 25–31, 5 figs. London, 15th February 1936.

Descriptions are given of the hitherto unknown male and of the female and first and second instar larvae of *Pseudococcus cocotis*, Mask., from coconut leaves and bark received from the island of Niue, near the Tonga Islands.

Borchert (A.). **Untersuchungen über die Morphologie und Entwicklungsdauer der Larven der Kleinen Wachsmotte** (*Achroea grisella* **F.).** [Investigations on the Morphology and Length of Development of the Larva of the small Wax Moth.]—*Zool. Jb.* (Anat.) **61** no. 1 pp. 99–106, 3 figs. Jena, 17th February 1936.

Of 176 larvae of *Achroia grisella*, F., 29 developed to the cocoon-spinning stage, and of these 3 had 10, 2 had 11, 13 had 12, 7 had 13, and 4 had 14 instars. From the cocoons, 12 males and 11 females emerged. The mortality of the larvae in each instar was studied. It increased up to the 5th instar, then lessened, but increased considerably in the 8th and 10th. The life-cycle from egg to adult of the 23 insects that reached the adult stage lasted 95–221 days, with an average of 151. The cocoon-spinning stage averaged 2·1 and the pupal stage 6·8 days. Measurements are given of the head capsule, prothorax and body-length of larvae in various instars.

Papers noticed by Title only.

Teranishi (C.). **Notes on the Pupa of** *Zephyrus* [*Thecla*] *saepestriata* **and its Parasite,** *Brachymeria obscurata*. [*In Japanese.*]—*Trans. Kansai Ent. Soc.* no. 6 pp. 35–39, 2 pls. Osaka, November 1935.

Shinji (O.). **A new Species of** *Eriosoma* **(Aphididae) from Japan** [*E. elsholtriae*]. [*In Japanese.*]—*Zool. Mag.* **48** no. 1 pp. 13–14, 1 fig. Tokyo, January 1936.

Goux (L.). **Notes sur les Coccides (Hem.) de la France (13e note). Etude d'une deuxième** *Rhodania* **nouvelle** [*R. flava*, sp. n., on *Festuca ovina*].—*Bull. Soc. ent. Fr.* **41** no. 3 pp. 35–40, 11 figs. Paris, 1936.

Balachowsky (A.). **Contribution à l'étude des Coccides des Colonies françaises (2e note). Sur la présence de** *Neomargarodes erythrocephala* **Green au Soudan français.**—*Bull. Soc. Hist. nat. Afr. N.* **26** no. 9 pp. 284–285, 3 refs. Algiers, December 1935.

China (W. E.). **A new Genus and Species of Capsidae (Heteroptera)** [*Kiambura coffeae*] **infesting Coffee in Kenya.**—*Ann. Mag. nat. Hist.* (10) **17** no. 98 pp. 326–328, 4 figs. London, February 1936.

Johnson (D. M.). **Leafhoppers of Ohio. Subfamily Typhlocybinae (Homoptera : Cicadellidae).**—*Ohio St. Univ. Bull.* **39** no. 29 ; also as *Bull. Ohio biol. Surv.* no. 31 (**6** no. 2) pp. 39–122, 5 pls., 2 pp. refs. Columbus, Ohio, 15th June 1935. [Recd. February 1936.]

Caffrey (D. J.). **The European Corn Borer : its present Status and Methods of Control** [*Pyrausta nubilalis*, Hb., in U.S.A.].—*Fmrs' Bull. U.S. Dep. Agric.* no. 1548, 38 pp., 36 figs. Washington, D.C., August 1935. [Recd. January 1936.] [*Cf. R.A.E.*, A **16** 118 ; **21** 169, 236 ; **23** 456.]

Rex (E. G.). **Information on the Japanese Beetle** [A survey of data on *Popillia japonica*, Newm., in U.S.A.].—*Circ. N.J. Dep. Agric.* no. 242, 34 pp., 15 figs. Trenton, N.J., June 1934. [Recd. January 1936.]

LUDWIG (D.). **The Effect of Desiccation on Survival and Metamorphosis of the Japanese Beetle** (*Popillia japonica* **Newman**).—*Physiol. Zool.* **9** no. 1 pp. 27–42, 1 fig., 17 refs. Chicago, January 1936. [*Cf. R.A.E.*, A **23** 59.]

CHRYSTAL (R. N.). **Bark-beetle Outbreaks and their Control : a Review of some recent Literature.**—*Forestry* **9** no. 2 pp. 124–131, 4 refs. London, December 1935. [*Cf. R.A.E.*, A **21** 648 ; **23** 222 ; **24** 22.]

PATAY (R.). **Sur un champignon** [*Beauveria doryphorae*] **parasite du doryphore** (*Leptinotarsa decemlineata* **Say**) [in France].—*Bull. Soc. sci. Bretagne* **12** no. 1–2 pp. 62–66, 8 figs., 4 refs. Rennes, 15th July 1935. [Recd. February 1936.] [*Cf. R.A.E.*, A **23** 290.]

SCHULZE (K.). **Die Biologie des amerikanischen Reismehlkäfers,** *Tribolium confusum* **Duv.** [The Biology of *T. confusum*, Duv. (a review of data from the literature).]—*Mitt. Ges. Vorratsschutz* **11** no. 5 pp. 62–64 ; **12** no. 1 pp. 4–5, 7 refs. Berlin, September 1935 and January 1936.

PARK (T.). **Studies in Population Physiology. V. The Oxygen Consumption of the Flour Beetle,** *Tribolium confusum* **Duval.**—*J. cell. comp. Physiol.* **7** no. 3 pp. 313–323, 13 refs. Philadelphia, Pa, 20th February 1936. [*Cf. R.A.E.*, A **23** 278, etc.]

ESAU (K.). **Initial Localization and subsequent Spread of Curly-top Symptoms in the Sugar Beet.**—*Hilgardia* **9** no. 8 pp. 397–436, 4 pls., 7 figs., 17 refs. Berkeley, Calif., July 1935. [Recd. January 1936.]

HENDEE (E. C.). **The Rôle of Fungi in the Diet of the Common Damp-Wood Termite,** *Zootermopsis angusticollis.*—*Hilgardia* **9** no. 10 pp. 499–525, 8 figs., 7 refs. Berkeley, Calif., August 1935. [Recd. February 1936.]

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). A new Pest of** *Abutilon avicennae* [in Uzbekistan]—*Carcharodus althaeae* **subsp.** *baeticus*, **Abt.** [*In Russian.*]—*Bolyezni i Vredit. nov. lubyan. Kul'tur* [*Dis. Pests newly cultiv. Fibre Plants*] pp. 107–108. Moscow, Izd.Novlubinst.VASKhNIL, 1933. [Recd. January 1936.] [See *R.A.E.*, A **24** 17.]

CHOPARD (L.). **Le phénomène des phases existe-t-il à un état rudimentaire chez certains Orthoptères** [Tettigoniids] **?**—*Bull. Soc. Hist. nat. Afr. N.* **26** no. 8 pp. 269–271, 4 refs. Algiers, November 1935. [*Cf. R.A.E.*, A **23** 702.]

Konferencje i narady w sprawach ochrony roślin w Ministerstwie Rolnictwa i Reform Rolnych oraz Sprawozdania ze zjazdow pracownikow Służby Ochrony Roślin w latach 1931, 1932 i 1933. [Conferences and Consultations on Protection of Plants held at the Polish Ministry of Agriculture and Agricultural Reforms together with Reports of the Meetings of the Workers of the Plant Protection Service in the Years 1931, 1932 and 1933.]—*Roczn. Ochr. Rośl.* (B) **2** fasc. 4 pp. 1–38. Warsaw, 1936.

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CONTENTS.

CONTENTS—*cont.*

CONTENTS—*cont.*

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